ASSESSING SUSTAINABLE URBAN FORMS IN ERBIL CITY OF IRAQ

Rebwar Ibrahim
BSc (Hons), MSc

A Thesis Submitted in Partial Fulfillment of the Requirements of the University of Wolverhampton for the Degree of Doctor of Philosophy

July 2016

Signature: *Rebwar Ibrahim*

Date: 13 / 07 / 2016

ABSTRACT

Scholars have frequently considered the analysis of sustainable design and performance of the built fabric over the past two decades with regard to diversity, density and accessibility. They fall short of developing a holistic, systematic and objective assessment system for the analysis of the sustainable urban form. Subsequently, there is still a noticeable gap regarding the relationship between these dimensions and the patterns and the layout of built environments in the Middle East in general and in Iraq in particular.

Intense and rapid economic development and urbanisation in Northern Iraq has resulted in expansive urban of built environments to accommodate the ever increasing urban population and level of activity in the city of Erbil. Architectural, planning and urban design trends at the intra-urban and neighbourhood levels indicate a state of disharmony and random physical forms that lack frameworks for understanding sustainable urban form in relation to urban patterns and layout. In this context, Accessibility, Connectivity, Compatibility, Diversity, Nodality, Density, Urban Identity, and Adaptability have been considered as analysis criteria to evaluate the sustainability of spatial patterns of urban form. The thesis aims to explore and examine the relationship between urban patterns and sustainable urban form in Erbil city in the context of sustainability through developing a customised but context-based framework for sustainable urban fabric indicators. To accomplish this, five case studies of residential projects with variable states of occupancy, completion, and social profiling have been chosen to investigate the practice of the sustainable urban form indicators.

The research adopted a mixed-methodological approach, which combines quantitative and qualitative surveys of users, planners, and decision makers to enhance an understanding of the local perception of urban sustainability. A random sampling process is applied for the quantitative survey when distributing the questionnaires. The successful sample size, which was analysed, was 252 respondents. Using comparative analysis of sustainable urban form indicators in the recent local residential projects, quantitative findings have noticeably indicated significant variation in the effectiveness of indicators' performance, and consequently support the research assumption with

statistical evidence that urban patterns have a significant impact on achieving sustainable urban forms in developing countries. The study concludes that the urban pattern indicator framework offers an efficient and rigorous approach that enables a credible assessment of the design strategies and planning decision-making in residential developments to achieve sustainable urban forms. These findings have evident implications for urban planners and policy makers during the design stage. The study has proposed practical planning and design guidelines which aim to enhance the local built environment.

DEDICATION…

In loving memory of parents

Ismail Ibrahim Al-JAFF
Hafsa Ali Rabati

Who have always believed in me and been the greatest source of inspiration and encouragement throughout my life

*To…..**Sally***

My wife, love, and friend

For her support, inspiration, encouragement, fortitude and unconditional love

*To…..**Lana, Laya, and Lin***

My daughters

For supporting me throughout my work, helping me and relieving me of other things so I could concentrate on working on my study

This effort would not have been possible without you all

ACKNOWLEDGMENTS

First and foremost, I would like to express my deepest appreciation to my primary supervisor Prof. Sabah Mushatat for his advice, guidance, encouragement, and unfailing support throughout the different stages of this research for nearly three years. My unstinted gratitude is extended to him. I am also deeply grateful to my supervisor Dr. Mohamed Gamal Abdelmonem, who has been very illuminating and supportive and provided expert guidance and encouragement through the whole duration of my research. I extend my unlimited gratitude to Dr. Asad Yacoub Jajo, Miss Cecilia Beth Jones, and Miss Sara Macleod who on different occasions gave me helpful comments and expert opinions for the completion of this research.

I am also grateful to the University of Wolverhampton, School of Architecture and Built Environment for offering me the opportunity to pursue my PhD studies and providing an extraordinary academic environment that contributed to, and enhanced, the development of my academic experience. In addition, I also would like to thank my current institute, University of Salahaddin in Erbil, Iraq for their administrative support and to all my colleagues and professors at the Architectural Department, College of Engineering, particularly Dr. Ali Izziddin, Dr. Mahmood Khyat, Dr. Hamid Turkey and Dr. Ahmed Basil. I am also deeply grateful to my colleagues Prof. Hashim Al-Mousawi, Dr. Hussien Ali Shekhbzainy, Dr. Najdat Zaki, Mr. Dara Al-Yaqoobi, Mr. Purtus Khammo, Dr. Rizgar Ali, Mr. Ali Althahab, Mr. Nabil Aljwadi and Mr. Maroof Abdulmomen for their great contributions to my knowledge, and valuable support with the empirical and field work of the study. A sincere thanks to all my colleagues who offered information, help and support throughout the stages of the study, particularly Dr. Ali Omran, Dr. Nabil Al-Jawadi, Dr. Sahar Alqaisi, Miss Ranan Tawfiq, Mr Sary Slewa, Miss Nashmil Shwan, Miss lana Daham Surchy, Mr. Raid Awni, Mr Ibrahim Hafidh, Mrs. Riz Shah, Miss Sabrina Mall, and Miss Haifaa' Mustafa.

Finally and the most importantly, I am deeply indebted and gratitude to my beloved brothers and sisters, especially my older sister Dr. Gulzar Aljaff, for their almighty support, pray and encouragement. Thank you all.

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GLOSSARY OF TERMS AND ACRONYMS

CBD: Central Business District

CEC: Commission of the European Communities

CNU: Congress for the New Urbanism

EPA: Environmental Protection Agency

GHG: Greenhouse Gas

HCECR: High Commission for Erbil Citadel Revitalization

IOM: International Organisation for Migration

IPCC: Intergovernmental Panel on Climate Change

KRG: Kurdistan Regional Government

MCA: Multiple Centrality Assessment

PASW: Productive Analytics Software

SFDUs: Single-Family Dwelling Units

SPSS: Statistical Package for the Social Sciences

SUD: Sustainable Urban Development

TOD: Transit-Oriented Development

UN: United Nations

UNCSD: United Nations Commission on Sustainable Development

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

UNESCO: United Nations Educational Scientific and Cultural Organisation

WCED: World Commission on Environment and Development

Chapter 1: Introduction

1.1 Introduction

The present chapter intends to highlight, globally and locally, the most important research related to urbanisation, urban form and sustainability in order to identify the research problems and questions. Accordingly, the main aim, objectives and research assumptions will be formulated. Finally, the chapter discusses the research framework, the main contributions and an outline of the study.

1.2 The Research Context

The studies related to urban settlements, the components of urban form and the establishment of theories for the development of physical sustainability have already been examined by many researchers and planners (Jenks and Jones 2010). Noticeably, the physical form of cities has been shown to have a crucial impact on achieving sustainable urban forms in rapidly growing and developing countries and has become the most recent concern among researchers and planners since they are witnessing a dramatic growth in urban cities (UN, 2010).

Today, the 'sustainable urban form' is an important element in a portfolio of solutions to the problem of meeting the need for planning and related development. Ruano (2009) suggests that the concepts of spatial planning of urban forms and the development of buildings and infrastructure have a number of direct and indirect impacts which, with current priorities, are clearly in conflict with the requirements of sustainable urban forms. For example, the United Nations Habitat (2010, p.7) has clearly indicated the dramatic increase in population on one hand (Figure 1.1), and linked it to the importance of sustainable urban development by stating that "sustainable urban development should meet the needs of the present without compromising the ability of future generations to meet their own needs".

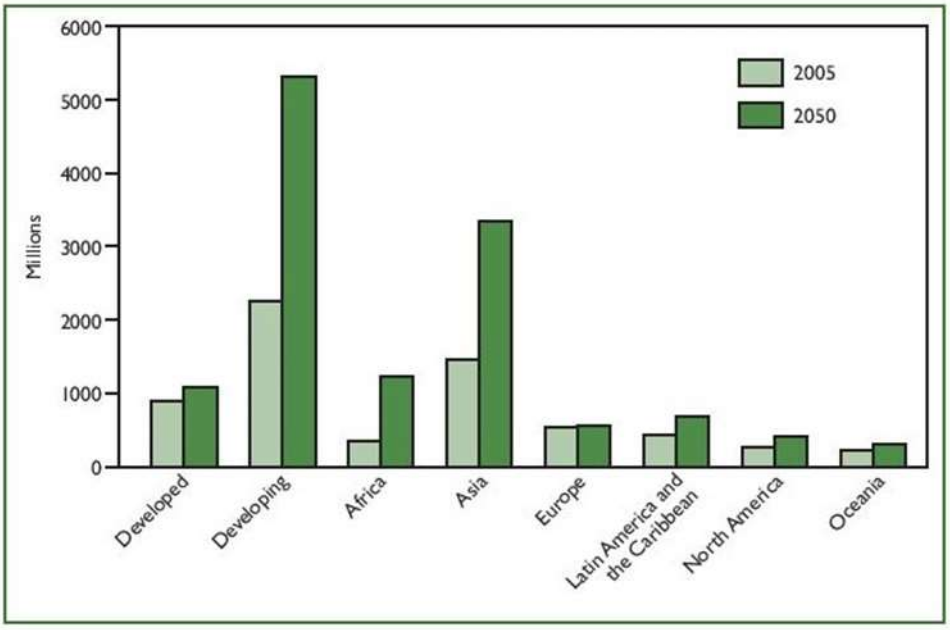


Figure 1.1: Urban Population by Region 2005-2050 (UN, 2010, P.8)

Many scholars have attempted to define and indicate the main aspects of sustainable urban development like Curwell et al. (2005), Elliot (2006), Wheeler & Beatley (2008) and Rydin (2010) who suggests that sustainable urban development refers to maintaining and enhancing quality of life socially, economically, physically and environmentally. Sustainable urban development specifically means attaining a holistic balance between the development of urban areas with and protection of natural resources, giving consideration to equity in social services, infrastructure, and quality of life in urban areas. Moughtin & Shirley (2005) claim that urban sustainability as part of sustainable urban development, is a contested term since many studies have argued as to what it encompasses, how to achieve it and how it would be influenced by context and different needs. Therefore, as such, it remains a subject of continuous debate among a wide range of scholars and practitioners involved in city- building and reconstruction. However, scholars and planners have apparently described sustainability of the built environment as the idea of creating and improving the quality of life of the city without disturbing the natural environment. Sustainable urban form is considered an essential part of urban sustainability which has

been discussed widely by authors and literature (Jenks et al 2000; Jabareen (2006), Haas (2012); and Masnavi (2011)). Most of these attempts have simultaneously agreed on the essential keys and principles of achieving a sustainable urban form. These common key principles are: appropriate access to facilities, diverse residential and mixed land use, multi-modal transportation, preservation of open space, identity and heritage locations, social cohesion and equity, and the involvement in the decision-making process.

Beatly et al. (2007) argues that new approaches to physical planning and the effective spatial pattern of urban forms are necessary for sustainable urban development in general and to create more sustainable urban forms in particular. Meanwhile wheeler and Beatley (2008) highlight that this interrelated operation demands that our communities must be planned properly and designed efficiently to re-establish and reinforce the quality of life, that districts must be human-scaled, and that neighbourhoods must be connected with the adjacent districts and diverse in use and population.

In Erbil, Iraq after 2003, there were rapid changes, concerning the constant migration of people from surrounding areas which has resulted in the rapid growth and transformation of the built environment of the city (Figure 1.2 and 1.3).. In addition, the consequences of the rapid population growth and urbanisation have led to many urban and planning issues. For example, the accelerated physical projects all over the city supported by local and global investments pose the question of physical sustainability regarding their development (Yassin, 2011). Moreover, the urban form in the latest projects in Erbil (especially, the residential projects) has developed in the direction of disharmonised urban patterns, a decreased degree of local identity and functional integration and an increased degree of dispersed and random settlements regarding proximity to local facilities and public transportation nodes (Akram et al. 2016; Ibrahim et al. 2014; and Khoshnaw 2016).

Figure 1.2 and 1.3: Erbil City 1933 and 1990 (HCECR, 2009)

1.3 Research Rationale

Urbanisation, the rapid growth of population, economic inflation, environmental changes, and the social equity related to sustainable urban development have become the main focus of many scholars and much literature. Many significant attempts to resolve these issues have theoretically and virtually been achieved in developed countries like United Kingdom, Germany and Sweden. Farr (2008) points out that many local governments in these regions have formulated urban development policies and plans at all levels and integrated all these issues and considerations into holistic urban development planning efforts. However, most of the attempts are still theoretical and the context of these available challenges in the developing countries has been hardly explored. Thus, the importance and feasibility of conducting this study have stemmed from the following points:

Firstly, there is a lack of holistic agreement regarding measuring sustainable urban form. For example, planners and researchers have used different parameters, dimensions, and indicators to measure sustainable urban form by depending on one aspect or more and avoiding the others (Jabareen, 2006).

Secondly, there is a lack of research which measures the urban pattern as an essential aspect of achieving sustainable urban forms. Moreover, there is a lack of holistic theoretical approaches that address the relationship between urban patterns and sustainable urban forms in the developed and developing countries (Jenks & Dempsey, 2005).

Finally, Erbil (Hawler in Kurdish), is the capital and the largest city of Iraqi Kurdistan. Having been continuously inhabited for about 6,000 years, the city has recently been regarded by UNESCO World Heritage as one of the world's oldest urban settlements. Following the changing geopolitical landscape of post-war Iraq, urban changes and socio-political transformation are largely driven by Erbil's growing autonomous status as the capital of the northern region of Kurdistan since 2003. Therefore, it is very important to focus on improvement of the quality of life, ameliorating the urban fabric, and attempts to rationalise the form and style of the historic city with the new urban developments in a sustainable manner.

1.4 Research Problem

There have been numerous studies and pieces of research in developed countries that focus on how and which urban form may significantly affect the sustainability of cities. Accordingly, Welbank et al. (1996) highlights that concepts of higher densities, mixed-use activities and spatial organisation of buildings have an important role in resolving problems related to unsustainable growth of cities. The sustainable urban form approach is claimed to be the most suitable model for cities in the developed countries. It has been discussed widely in many studies and also has been offered as a possible solution for achieving physical sustainability as a part of sustainable development in cities in the developing countries (Jenks et al., 2000; Bertaud, 2004).

Literature has indicated the significance of the patterns of building arrangements, the unsustainable growth of cities in developed countries and their link to urban forms. Many

cities in developing countries are currently undergoing a similar economic growth and urban development to that experienced by developed countries in the last century. Sorensen et al. (2011) suggests that it is very important to guide these cities to develop in a sustainable way to protect the global environment from any further harm. Talen (2011) asserts that research on urban form patterns and the most significant indicators that can deliver sustainability has not been explored comprehensively and the relationship between the spatial patterns of urban form and achieving sustainable urban forms in the developing countries has not been investigated yet. Therefore, the relevance of the spatial organisation of buildings has remained untested in these cities.

Locally, Erbil's built fabric has been influenced by modern architecture and urban design trends. Various residential projects have been erected and different types of spatial arrangements of these structures have appeared with limited attention to sustainability criteria. Gradually, research has been carried out, but most has dealt with social, environmental or physical issues only partially or indirectly. Thus, more than one problem may be identified:

1- There is no available holistic conceptual framework of spatial patterns of urban forms and the most experienced concepts of and approaches to sustainable urban forms.

2- There is a lack of research that investigates the relationship between urban patterns and their essential role in achieving sustainable urban forms according to a significant practical framework of indicators.

3- Locally, there are no specific planning approaches and models of how urban forms are spatially arranged to achieve the required performance of sustainable urban forms. Hence, this lack of planning approach hinders attempts at research-led or informative decision making on the part of the planning institutions.

1.5 Research Hypothesis

This research contends that the existing urban forms and spatial planning of numerous projects in Erbil city are incompatible with the sustainable urban form criteria and there is no holistic view to explore the various contexts of sustainable urban forms in the city. Depending on this statement, two more specific hypotheses can be formulated:

1- The spatial pattern of urban form has an essential impact on achieving sustainable urban forms in the current residential projects in Erbil city.

2- There are systematic and tested approaches to the sustainable spatial patterns of urban form to which need to be customised to suits the contextual factors to govern the development of the current residential projects in Erbil city.

1.6 Research Questions

Apart from the research statements, the broad question, this research seeks to investigate will be: in what way could urban planners and architects examine, test and improve the relationship between the spatial patterns of contemporary residential projects and the development of sustainable urban forms in Erbil City in Iraq? Taking Erbil as a case-study city for its peculiar and rapidly growing urban development in the region, the research will examine the relationship between the spatial patterns of urban fabric, including residential building layout, and the organization of urban fabric in the residential districts, and its role in achieving sustainable urban forms. To address the main research question, the following specific questions will be derived:

- Which sustainable indicators related to urban patterns should be considered locally to achieve sustainable urban forms?

- Does the spatial pattern of the urban forms have any impact on achieving sustainable urban forms in the recent residential projects in Erbil city?

- Are there any current specific models or approaches to how urban forms are spatially arranged to achieve an adequate sustainable urban development locally?
- How do these indicators perform in the recent residential projects?

1.7 Aims and Objectives

Throughout the last century and the first decades of the twenty-first century, war disasters and economic sanctions and rapid growth and acceleration in urbanisation have had a major impact on the built environment of the Kurdistan region. During the last decade, the city has become one of the most important destinations in the region and it is undergoing a prosperous period of urban transformation. Several projects have been accomplished and many others are under construction. Particular attention has been paid to residential projects to facilitate the current growth of the population. The main aim of this study is to explore the relationship between urban pattern and sustainable urban form and to evaluate the current local urban form and pattern approaches in terms of sustainability and to eventually compare these approaches with the global orientations that will enhance the urban sustainability of the city. Finally, the study will attempt to adopt the following objectives: -

- To develop a comprehensive theoretical framework that addresses the relationship between the spatial arrangements of urban form and all the studies of, concepts of and approaches to the sustainable urban form.
- To establish a sustainable practical framework of indicators that relate to spatial patterns of urban form and compatible with the local built environment.
- To explore the performance of urban patterns indicators and parameters to address the role of spatial urban patterns in achieving sustainable urban forms locally.

- To investigate whether the current urban patterns are relevant to the local context and spatially arranged according to the sustainable urban form criteria.

- To create practical planning and design guide lines in order to enhance the local built environment (Table 1.1)

Table 1.1: The Relationship between Research Objectives, Research Questions, Hypotheses and the Relevant Chapters.

Research Objectives	Research Questions	Hypotheses	Research Methods	Relevant Parts of the Thesis
To develop a comprehensive theoretical framework that addresses the relationship between the urban patterns and sustainable urban forms	In what way could urban planners examine and improve the relationship between the spatial patterns of residential projects and the development of sustainable urban forms in Erbil city?		Literature Review	Chapter 2,3 and 4
To establish a sustainable practical framework of indicators that relate to spatial patterns of urban form and compatible with the local built environment.	Which sustainable indicators related to urban patterns should be considered locally to achieve sustainable urban forms?		Literature Review	Chapter 5,7
To explore the performance of urban pattern indicators and parameters to address the role of spatial urban patterns in achieving sustainable urban forms locally.	Do the urban patterns have any impact on achieving sustainable urban forms in the recent residential projects in Erbil city?	The spatial pattern of urban form has an essential impact on achieving sustainable urban forms in the current residential projects in Erbil city.	Empirical field work and analysis	Chapter 8
To investigate whether the current urban patterns are relevant to the local context and spatially arranged according to the sustainable urban form criteria.	Are there any current specific approaches to how urban forms are spatially arranged to achieve an adequate sustainable urban development locally?	There are systematic and tested approaches to the sustainable spatial pattern of urban form which need to be customised.	Empirical field work and Interview analysis	Chapter 8
To create practical planning and design guide lines in order to enhance the local built environment.	How do these indicators perform in the recent residential projects?		Empirical field work analysis and recommendations	Chapter 8 and 9

1.8 Research Design

The research framework is accomplished through three interrelated stages. The first phase formulates a holistic literature review on spatial patterns of urban form and sustainable urban form. This stage aims to investigate the issues and components which are related to urban form, patterns and layouts and their relationship to the various concepts and approaches to urban sustainability to derive the significant elements and criteria for achieving sustainable urban forms. Finally, the expected outcome for this stage is the creation of a comprehensive theoretical framework that addresses the main approaches to the spatial patterns of urban form and its relationship to the concepts of sustainable urban forms.

In the second phase, a practical framework of spatial patterns of urban form indicators is formulated (derived from previous concepts and related studies), that considers the main criteria to investigate the importance of building patterns and layout in achieving sustainable urban forms. This practical framework of indicators is used to evaluate the current existing residential projects in Erbil city. The study data will be collected through a mixed method including qualitative and quantitative surveys. The quantitative part consists of a questionnaire survey regarding the view of users and experts of the new residential dwellings. This survey attempts to investigate the relationships between urban patterns of building and their roles in achieving sustainable urban form in Erbil city. The qualitative case study survey includes an observational study of residential urban form in the city. It covers site visits, observation analysis, checking, comparing and documenting of various existing urban projects and professional semi-structured interviews with the personnel involved in the planning and decision making. The purpose of the observational study is to explore, describe the urban layout and evaluate the current built environment.

In the final phase, all the information and data will be analysed according to qualitative and quantitative methods. The first will focus on visual building maps and images analysis using comparative tables according to sustainable urban form parameters. The second analysis relies on quantitative analysis like: descriptive analysis, the Onaway-ANOVA, and T-test analysis. Then the data outcomes will be statistically analysed by the SPSS program. The research results will illustrate the final conclusions and recommendations (Figure 1.4).

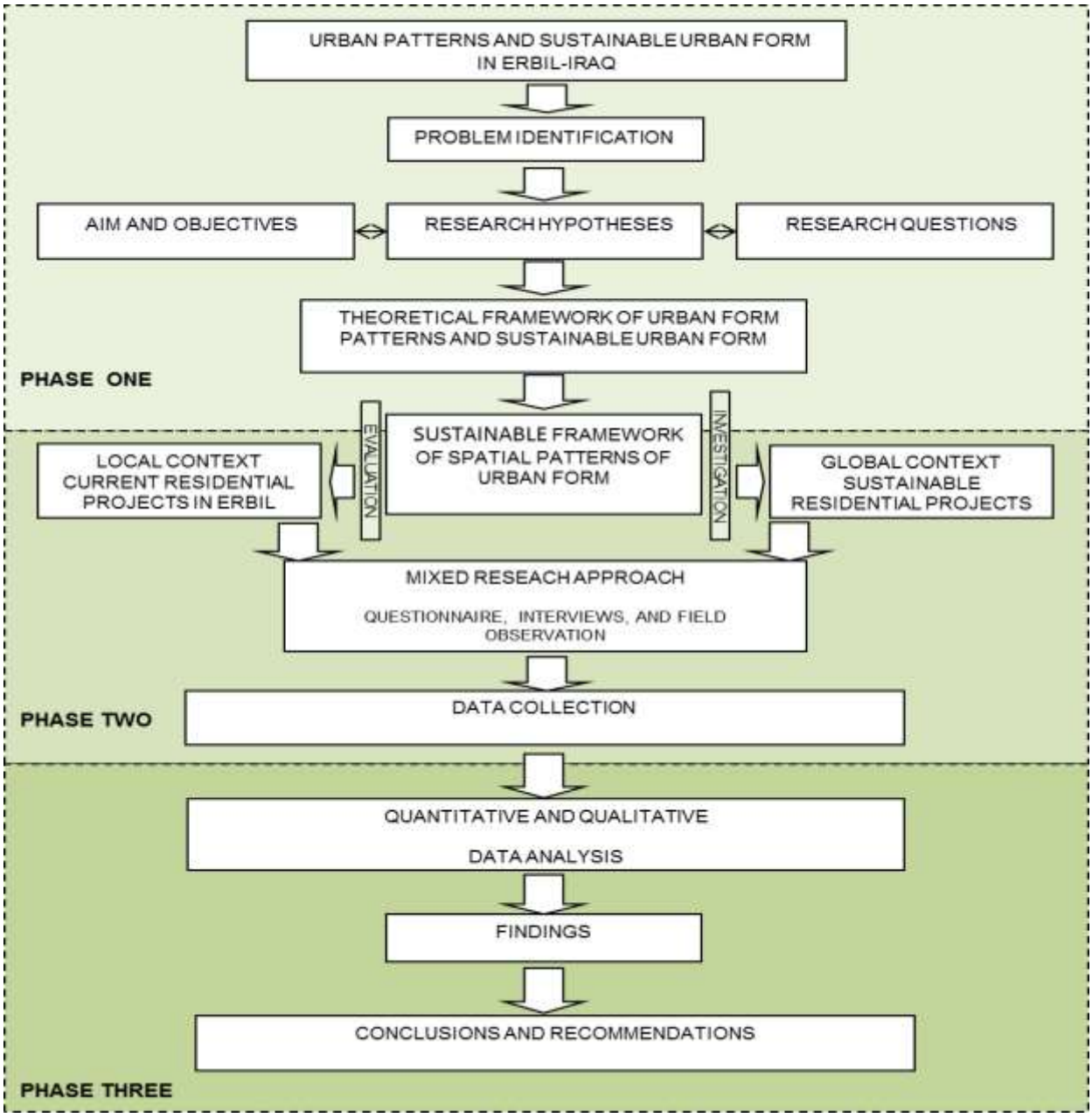


Figure 1.4: Research Design

1.9 Research Dissemination

This study can be beneficial to many sectors as follows:

1- **Planning Authorities** which are the main bodies responsible for the planning, designing and developing of residential areas in the Kurdistan region. The government gives the local authorities of each city responsibility for planning their cities, specifying the use of land, dividing the plots and choosing the size of plots in accordance with the needs of each governorate. This research is a useful planning and design guideline to achieve sustainable urban forms in the region.

2- **Municipal and Local Authorities** which are responsible for approving housing planning and specifying the building materials and everything else relating to buildings. The standards, codes and instructions are approved by the municipalities and so their impact on the form of the built environment is readily apparent. The Kurdistan Board of Investment is also an important institution which contributes to supporting the planning and construction of many recent projects. Their library will be provided with this significant effort and other recent publications to enhance local knowledge regarding local planning issues and propositions within the context of sustainability.

3- **Academic Institutions** are the leading authority for teaching in architecture, and urban planning and design which all play an important role in training of architects and planners. This thesis is considered an essential reference for students in the fields of urban development, green issues and sustainability. Furthermore, internal seminars will be presented to describe the structure, contents and contribution of this effort to the teaching staff and the students.

4- **Architectural and Planning Consultant Offices** which prepare and supervise the various stages of the design process. This study will play an important role in guiding and assisting these offices to accomplish their project according to the global manner and

according to the latest ‘sustainable urban form’ check list. A brief copy will be sent as a brochure to all consultant offices which have contributed to and supported the field survey of this study.

1.10 Structure of the Thesis

The research is organised into nine chapters, each reflecting on a particular theme, starting with an introduction to the literature and a summary at the end.

Chapter 1: The Introduction is a general introductory chapter. Furthermore, it outlines the most important efforts and topics related to this research to clarify the problems, objectives and aims behind the study. Research hypotheses, questions, and the methodology framework will be determined by these assumptions. Research Dissemination, contributions and the chapters’ contents sum up the first chapter.

Chapter 2: The Urban Form seeks to review briefly the historical development of urban form and how it has changed through the ages. The chapter demonstrates also various directions in urban form definitions, its structures and the essential elements that compose the built environment in the city. Several approaches to urban form types supported by examples have been explored depending on intensity, paths of movement and future development.

Chapter 3: The Thematic Approach is an analytic approach towards the definition of the research problem. It describes objectively how the literature addresses the problem and its related context. Moreover, various concepts, issues and challenges are reviewed to constitute a holistic framework regarding the research problem.

Chapter 4: Sustainable Urban Form is devoted to exploring the context of sustainable urban form. It reviews the main aspects of sustainable urban development in general and focuses on the physical features in particular. In order to secure sustainable pathways for urban development and constitute a holistic vision of an urban pattern paradigm and

sustainable urban form, the chapter describes substantially different types of sustainable city concepts and illustrates many related global examples.

Chapter 5: Dimensions and Indicators of Sustainable Urban Form explores factors and indicators (derived from previous related studies), that consider the main criteria to achieve sustainable urban form in the cities generally and to evaluate the current existing urban pattern. The chapter focuses, in the second part, on the various experiences all over the world that are concerned with the spatial arrangements of a sustainable built environment. These case studies are chosen from different contexts and criticised depending on the criteria and dimensions of sustainability to achieve and gain a holistic framework.

Chapter 6: Research Methodology describes the theoretical approaches to research methodology. It compares the positivist quantitative approach with the interpretive qualitative approach to research, and the mixed approach. The chapter covers in the second part the various research tools which have been adopted by the study and how each method has been practiced locally. The third part illustrates the local residential projects which have been studied and evaluated.

Chapter 7: The Urban Development of Erbil City addresses and evaluates the current state of the built environment of Erbil city and the different stages of its urban development and growth. The chapter explores also the traditional and historical built environment and compares it to the modern and contemporary urban forms. Moreover, it presents and discusses the current executive housing policy to reveal the extent to which it complies with the principles of sustainable development.

Chapter 8: Analysis and Discussion focus on the urban study of Erbil. It presents the overview of data collection in the first part of the chapter and in the second part it

demonstrates the analysis of the results. The findings of the research will lead to the conclusions and recommendations.

Chapter 9: Conclusions and Recommendations is the final chapter which presents the research conclusions and key findings. It attempts to validate the main assumption of the study and discusses how the study has answered the research questions. Also, it indicates the research's contribution to evaluating the built environment of Erbil city in terms of sustainability. Finally, it discusses the study limitations and proposes recommendations for future research.

1.11 Summary

This chapter has provided an introduction to this thesis which is focused on the development of the research context, the purpose of the study and the identification of the research problems. The research discusses the gap in the knowledge regarding the measurement of spatial pattern of urban form and its essential role in achieving sustainable urban forms recently. In accordance with the research problem, the chapter formulates the main arguments, research questions and the objectives of the study. The chapter discusses the appropriate research design which intends to provide the action plan, or strategy to be used to answer the research questions and achieve its goals. Moreover, the chapter presents the research design which clarifies the specific steps and procedures of how the research will be undertaken. Finally, the chapter clarifies the institutions which will benefit from this study and gives a brief description of each chapter.

The next chapter, Chapter 2, will investigate the notion of urban form and the significant related elements and approaches. The chapter illustrates, finally, the main concepts and approaches regarding the spatial patterns of urban form which have been discussed by the available literature.

Chapter 2: The Spatial Patterns of Urban Form

2.1 Introduction

This chapter seeks to review briefly the historical development of the urban form and how it has changed throughout the ages. The chapter demonstrates also different directions in definitions of the urban form, its structures and the essential elements that compose the built environment in the city. The chapter discusses several approaches to the urban form types and patterns supported by examples and depending on different characteristics like intensity, paths of movements and future development.

2.2 Urbanisation and the Urban Form

Today, most developing countries are witnessing the process of industrialising and urbanising, and beginning to face further challenges of making their own long-term developments. Urban planning will thus have a major impact on shaping the future of these regions. Accordingly, Jabareen (2006) highlights that rapidly growing cities are facing considerable challenges like: the increasing number of migrants, the segregation-intensification equation, and the impact of environmental problems. The past centuries have been characterised by a structural trend towards urbanisation. United Nation report (2014) indicates that some 200 years ago less than 20% of the world population lived in cities, whereas in the late of 2014, 55 per cent of the world's population was urban. Not only has the number of cities increased rapidly, but also the size of cities (Figure, 2.1).

Hall (2002) defines the 20th century as the century of urbanisation, and the 21st century could be recognised as the century of urban transformation while, Yang (2010) describes it as the era of sustainability. Suzuki et al. (2013) suggests that urban population growth and spatial expansion are expected to increase due to the attractive living, services and job opportunities which are provided by the city. He adds further that the intensification of

population in urban regions leads consequently to further extension of urban settlements in the form of informal urban shelters and segregated dwelling units.

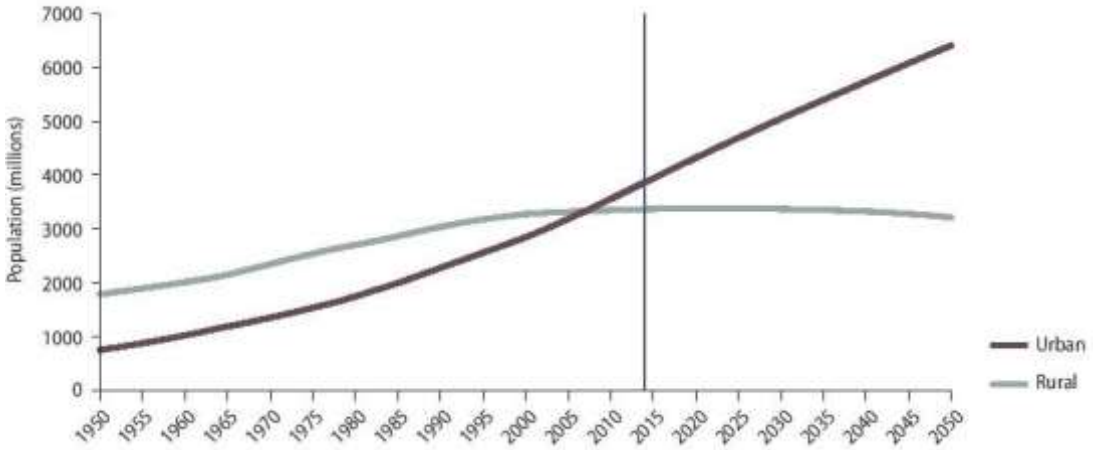


Figure 2.1: Urban and Rural Population of the World, 1950-2050 (United Nations, 2014, P.7)

2.3 Brief Historical Review

The urban form has changed dramatically throughout the ages. Various types of circumstances including traditional values, philosophy, population size, political systems, design technology, building methods, transportation, energy and globalisation have ultimately influenced the form of settlement chosen.

Morris (1972) mentions many characteristics of the Neolithic Age and the Agricultural Revolution between 10,000 CE - 3,500 BC like the planting of grains, and domestication of animals; and he adds that the first civilisations emerged during this period; Mesopotamia: Egypt, Indus Valley, Yellow River in China, Valley of Mexico, and the Coasts and highlands of Peru. Ur, in Iraq was once inhabited from about 5500 BC (Figure 2.2). Kostof (1992) claims that this ancient civilization was finally abandoned around 400 BC because of difficulties with its water supply. Mumford (1989) argues that during the era of the Greeks, geometrically-regular schemes other than grids were proposed and built. Geometric schemes have provided the simple order in the classical sense. Straight streets and the grid have often revealed the power of the governor and his will to impose his chosen order.

Figure 2.2: City Form and Planning of Ur, Iraq (Morris, 1974, P.8)

Morris (1994) and Lefebvre (1996) claim that the era of the Romans witnessed other urban forms and planning characteristics. The influence of military concerns on the street layout has often been large scale on Roman imperial planning. Military thinkers have sometimes preferred the grid arrangements, which include characteristics of legionary towns: grid streets, forum, theatre, baths, and the library. Kostof (1992) adds that by medieval times, the urban form had entirely lost its regularity while maintaining some of its original topology from the start of the Renaissance, the plot and building plans began to be filed in city halls. Giddens' elaboration (Giddens, 1990, P.100) on pre-modern European cities shows how urban and physical spaces were interlinked and had distinctive features in most common forms of settlements at that age (Figure 2.3). He states that "*Cities were ordinarily walled, the walls emphasising their enclosed character and their separation from the countryside, and also serving the purpose of military defence*".

The "Modern" era was already spreading well by the time industrialisation began to influence cities. However, Gympel (1996) indicate that modern architecture arose about a century after the start of industrialisation, in part as a responsive movement. The tragic

transformation, what modern space did to traditional space, it transformed the liveable space (lived spaces of shared and attached memories, values and cultural practices) out of the community and replaced it with an artificial one.

Figure 2.3: Medieval District, in Italy (Moughtin, 2003, P.142)

However, Lefebvre (1996) adds that the most significant elements and features of the modern urban fabric were land –use identification and zoning of the city into residential and commercial areas and the creation of systematic streets as a mere infrastructural corridor.

Although historical Arab cities show a variety of origins and growth patterns, they were however influenced by the common social, geographic, and religious factors leading to similar morphological principles developing the urban fabric (Saqqaf, 1987). Like most cities, the original locations of Arab settlements depended on availability of natural resources such as water supply, locations of existing trade routes, and sometimes adjacent to the religious significance of certain places (Azzam, 1993). While the origin of the city was dependent on the mainly mentioned external factors, Bianca (2000) argues that the Arab city's traditional development pattern was affected by a variety of other factors, one of which is the division of the social hierarchy (Figure 2.4).

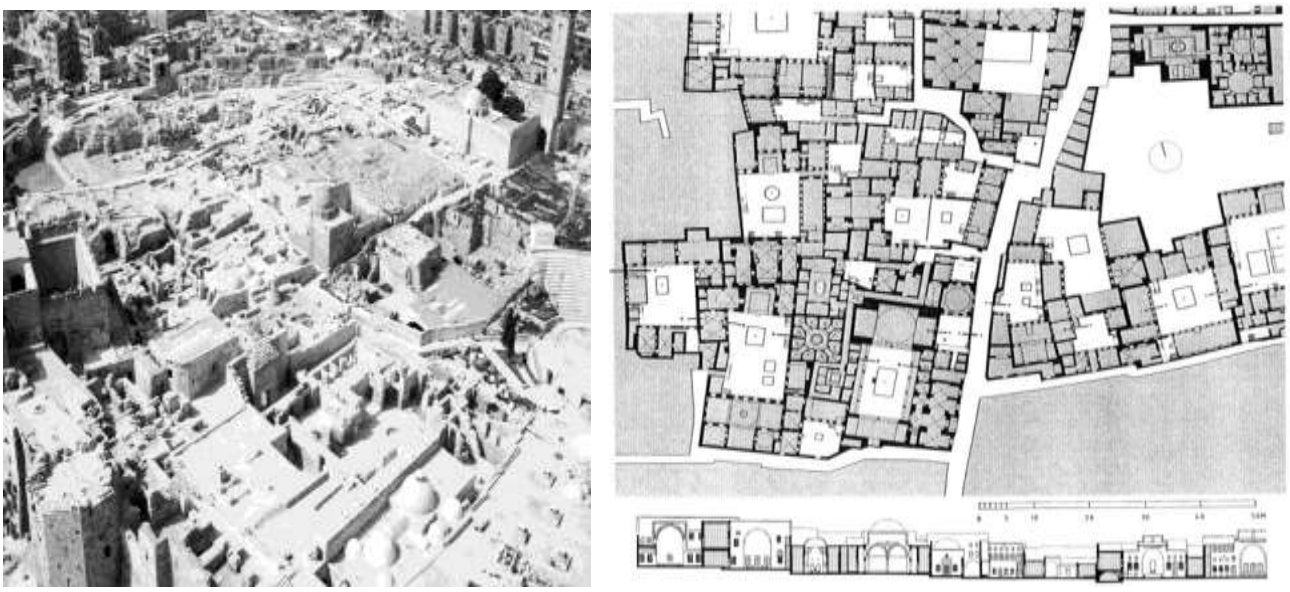


Figure 2.4: Urban Form in Aleppo, Syria (Bianca, 2000, P.312)

He adds further that the configuration of the Arab City is created by a repetition of cellular blocks and clusters around an organic linear street on a different scale. The systematic arrangements of these residential clusters, turns the urban fabric into a system of hierarchical elements of various sized units creating a complex pattern of unity and homogeneity.

2.4 The Urban Form

The term ‘urban form’ has been interpreted and defined by many scholars and literatures according to the context of the study. Urban form apparently may be affected by several variables like globalisation, history and geo-climatic impacts and has different interpretations like; physical, social and environmental (Figure 2.5).

Madanipour (1990) defines urban forms as the spatial configuration of a city’s activities. He argues that it can be classified into three categories: intensity, mixed-land use and spatial-structure arrangement. Tsai (2005) believes that the spatial structure of a metropolitan area, possibly defined as the ultimate urban form, may characterise such land use

phenomena as mono-centric versus polycentric forms; centralised versus decentralised patterns developments.

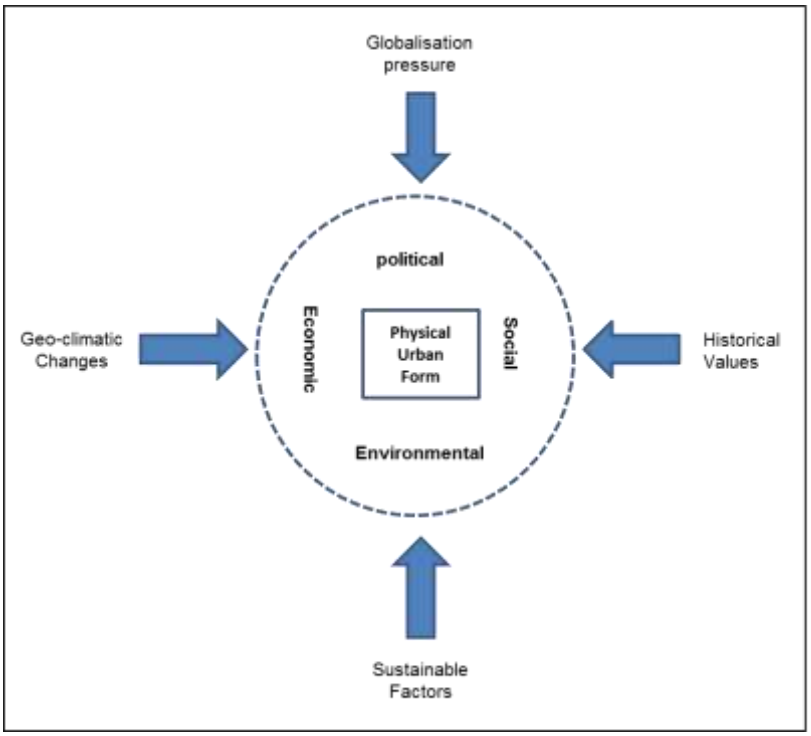


Figure 2.5: Urban Form Interpretations and Influence Factors

.Carmona (2003) believes that the city's urban form is shaped by: location and design of streets, paths and open spaces, and the mix of uses and activities that are allowed in each area of the city. Further, Lynch (1984,P.38) states *" the settlement or urban form is the spatial arrangement of persons doing things, the resulting spatial flows of persons, goods, and information, and the physical features which modify space in some way significant to those actions".*

The urban form may also refer to the spatial distributions of different land uses connected to the built infrastructures and associated with transport networks (Cuthbert, 2011). The Urban Task Force report (1999, P.28) defines the urban form as "*the general pattern of building height and development intensity and the structural elements that define the city physically".* Grosvenor and O'Neill (2010) elaborate the definitions of urban form and urban spatial structure to allow for both spatial and aspatial (not spatial) dimensions of the city. They

define urban form as the spatial pattern or ‘arrangement’ of individual elements within a city system at a certain point in time. These elements include built environment, buildings and land uses, as well as social interaction, economic activities, and public institutions. Ghosh and Vale (2009) indicate that land use characteristics, site layout, designs of built- up structures, planning policies and resident community preferences generate capabilities and qualities in different urban forms. While Dempsey highlights that the urban form may vary according to identified aspects such as building arrangement, types and materials; façades and fenestration, and street layout. Furthermore, it is concerned with non-physical characteristics like; social activities and economic elements (Dempsey et. al., 2005).

Here, in this study, the spatial patterns of urban form refer to type and layout of building arrangements in urban residential neighbourhoods, and the whole urban fabric as the combination of these physical component parts. It is also possible to focus on the space between these parts in the study of patterns of streets and squares.

2.5 Urban Form Components

The term ‘urban form’ is used conversely with ‘the built-environment’ to describe physical and geographical properties of cities, its components and infra-structure. Urban form generally encompasses a number of physical features and nonphysical characteristics. These are categorised here as six broad and inter-related elements that constitute urban form in cities like: land-use distribution, densification, building type and massing, pattern, transportation and infra-structure, and the hard or soft open spaces (Figure 2.6). This interrelationship between more than one element associates and contributes in the sound coherence of urban form (Dempsey et al., 2012). The next section will describe each aspect separately as follows:

Figure 2.6: Urban Form Components

2.5.1 Land Use Distribution

Land use is an equally important tool that determines the nature of urban form. Therefore, it has been defined by the Governmental Panel as the total of arrangements, activities and inputs that people undertake in a certain land cover type (IPCC, 2000). the term land use is used to describe the different functions of the environment within the urban context, the dominant land use tends to be residential but a functional urban area requires industrial, retail, offices, infrastructure and other uses (Polzin, 2004).

2.5.2 Density

Urban density has been identified as an urban form indicator with socio-cultural and environmental impacts recently (Santamouris, 2006). Density refers to the number of people (living) in a certain land area (Figure 2.7). Pont and Haupt (2009) argue that there is a significant difference between urban density which is described while referring to the built environment and the other urban density which is used for the measurements during the process of planning and designing the city. More details will be explained in chapter 5.

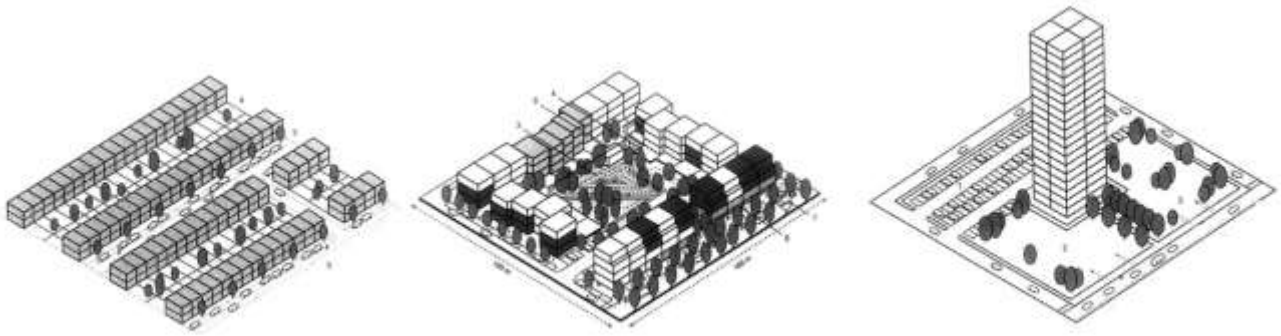


Figure 2.7: Different Urban Form Density on the same Area (Pont and Haupt, 2009, P. 17)

2.5.3 Building Type and Massing

The building blocks of our communities, schools, local shopping areas, housing subdivisions, apartment complexes, and the office parks, have all grown into forms that defy human scale (Calthrope and Fulton, 2007). The characteristics and types of buildings, their massing and height in urban settlements can have an essential impact on the performance of the urban forms regarding a number of issues. These may include climatic issues, socio-cultural aspects and quality of life (Jenks et al., 2008).

2.5.4 Pattern and Layout

The urban form may be defined as the spatial arrangement of city elements and infra-structure within a metropolitan region. This includes the spatial pattern of urban blocks and their densities (Moughtin, 2005). Layout and urban pattern describes the type of and spatial arrangement and configuration of buildings and street networks (Figure 2.8). Larkham (2006) has asserted the importance of urban pattern and arrangement and its direct impact on environmental design, neighbourhood quality, and achieving sustainable urban form.

Figure 2.8: Spatial Urban Pattern, Stratford Metropolitan City, London-UK (Moor and Rowland, 2006, P.20)

2.5.5 Transportation and Infra-Structure

There is a fundamental relationship between urban form and the transportation system which services the city (Moughtin, 2005). Access and transportation infrastructure are closely associated with density and land use and layout characteristics; this determines the ease of access to spaces and places. The relationship of urban density, transport and infra-structure is considered one of the main parameters in describing the form of the city (Suzuki et al, 2013).

2.5.6 Green and Open Spaces

Any urban structure like the neighbourhood node consists of a population large enough in number to create an independent community which consists of adequate urban form and public realm (kriken et al., 2010). Open spaces like; streets and parks are all part of the continuous urban form (Figure 2.9). According to this, the relationship between urban form and open spaces is spatially configured and socially contiguous. Thus, open spaces are not

the only urban territory where social activities can take place but, should encourage social interaction since that adds life and vitality to the built environment (Mell, 2010).

Figure 2.9: Green and Open Spaces, University of Koya, Iraq (R. Ibrahim)

2.6 Urban Form Approaches

Approaches to the study of urban form have been as diverse as the approaches to its definition. Many researchers have attempted to explore the different approaches of urban form. Madanipour (1990) states that urban form approaches can be categorised under two main frameworks Geography and Architecture. He discusses further the meaning of urban form under both disciplines separately. Geography defined urban form in relation to the whole of the earth's surface then narrowed it down to represent the intra-urban studies in urban geography, while Architecture was mainly concerned with single building design and construction, then extended it to cover the whole city.

The current literature addresses a range of main urban form approaches, including historical, environmental, conceptual, and morphological. Accordingly, a variety of different definitions and hierarchies relating to the built environment have been suggested by different authors from different theoretical backgrounds over the years. The following sections clarify briefly each approach individually as follows:

2.6.1 Historical Approach

One of the major research directions in the design approach is to envisage the city as an 'historical creation' or an 'historical process' (Moughtin, 2005). An important branch of the historical approach has been dealing with describing the architectural styles, theories and the development of numerous urban forms through historical periods with an attempt to explain the urban pattern, social life, and political systems (Morris, 1994).

Madanipour (1990) indicates the similarity between this approach and that of historical geography with one significant difference, that architecture focuses more on design details. Moreover, Kostof (1992) tries to explain the development of cities by demonstrating the significant transformation that has been witnessed through the daily life of the cities. Morris (1994) describes the studies of historical approaches to urban form when he argues that cities are considered through their morphological component parts such as, in the case of medieval cities, walls and gates, streets and circulation spaces, market places, church, and the mass of general town buildings. Many other authors like Lynch (1994) and Gympel (1996) have constituted major lines of investigation on the history of urban form.

2.6.2 Environmental Approach

Recently, the spatial arrangement of urban forms and its relationship to environmental issues and approaches has been the ultimate topic in many empirical and theoretical studies. In major urban areas, in developed and developing countries, awareness among people has been increased regarding the quality of their local environment and its vital impact on the quality of their lives (Santamouris, 2006). Therefore, good environmental management has become an essential policy for the economic and social vitality of cities.

Many urban researchers argue that the integration between urban forms and natural processes is considered one of the most important solutions within the context of sustainability (UN, 2009). Breheny (1992, P.156) states "*The relationship between urban*

form and environmental improvement may not be as direct as planners would like; Complex political, economic, and social factors determine this relationship as well as urban form". Thus, the historical development of the city is also perceived by many authors and scholars as a sequence of environmental adaptations which are reflected in the city plan and its constituent buildings both individually and in groups (Farr, 2008).

Finally, cities as many of the scholars observed, are complex entities and there are a vast array of political, economic and social issues beyond urban form that influence the impact of residents on the environment (Moughtin, 2005). The interaction between built environment, urban activities and the natural environment has become one of the substantial indicators in the assessment of sustainable cities (Jenks et al., 2000).

2.6.3 Conceptual Approach

The pattern of conceptual development of urban form, consistent with the urban developments of the post-war period, shows an oppositional movement towards the accepted norms (Grierson, 2000). This is reflected in the contrast between modernism, the established post-war approach to design, and post-modernism, which emerged as a reaction to it from the 1960s (Jencks, 2011). This contrast has deeply affected the way urban form and phenomena have been explained. Moreover, the relationship of modernism with pre-modern and post-modern schools of design and thought and the attempts which have tried to combine these relationships with improving the built environment have provided valuable visions to the dynamics of both form and the function contexts (Madanipour, 1990). It should be noted, however, that, although the approach has not developed a complete conceptual framework, it has provided considerable information on architecture and urban forms, which has helped understanding of urban design and basic elements of the internal structure of the cities (Lynch, 1984).

2.6.4 Morphological Approach

The Morphological approach was initiated by the Austrian architect Camillo Sitte in 1889 who advocated the principles of continuous building (Mandeli, 2011). Many Scholars have addressed the importance of this approach in defining the built environment. 'Morphology' refers to the pattern of streets, blocks, lots, and buildings. Such a pattern can have significant effects on neighbourhood quality, character, and functionality (Talen, 2009). Many scholars argue that in order to obtain a better understanding of urban form, our investigations of its nature and its components should be multidisciplinary in their focus in a way that integrates the spatial and morphological aspects with human, social, cultural and historical dimensions (Carmona and Tiesdell, 2007). Urban geographers have also attempted to study urban morphology offering considerable opportunity for the understanding and appreciation of historical and morphological context. This approach to urban form has been criticised as leading to environmental determinism, ignoring the economic, political, and cultural context within which buildings have been produced (Madanipour, 1990).

In general, the review of the literature has clarified the significant role of urban form and attention should be paid to the way urban fabric is being produced locally and globally. There is also a common consensus that the various issues of urban form and the social, economic and environmental aspects are interchangeably related. Focusing on such interaction would enable the research to take advantage of the insights offered by different lines of inquiry in urban design and architecture. These varied approaches, which are related to the notion of urban form, reveal on the other hand its importance and vital characteristics to constituting a theoretical conception to enrich the holistic framework regarding the main direction of this study.

2.7 Scales of Urban Form

The scales at which urban form can be considered or measured include the individual building, street, urban block, neighbourhood and city (Figure 2.10). These levels of spatial integration influence how urban form is measured, analysed and ultimately understood (Frey, 1999).

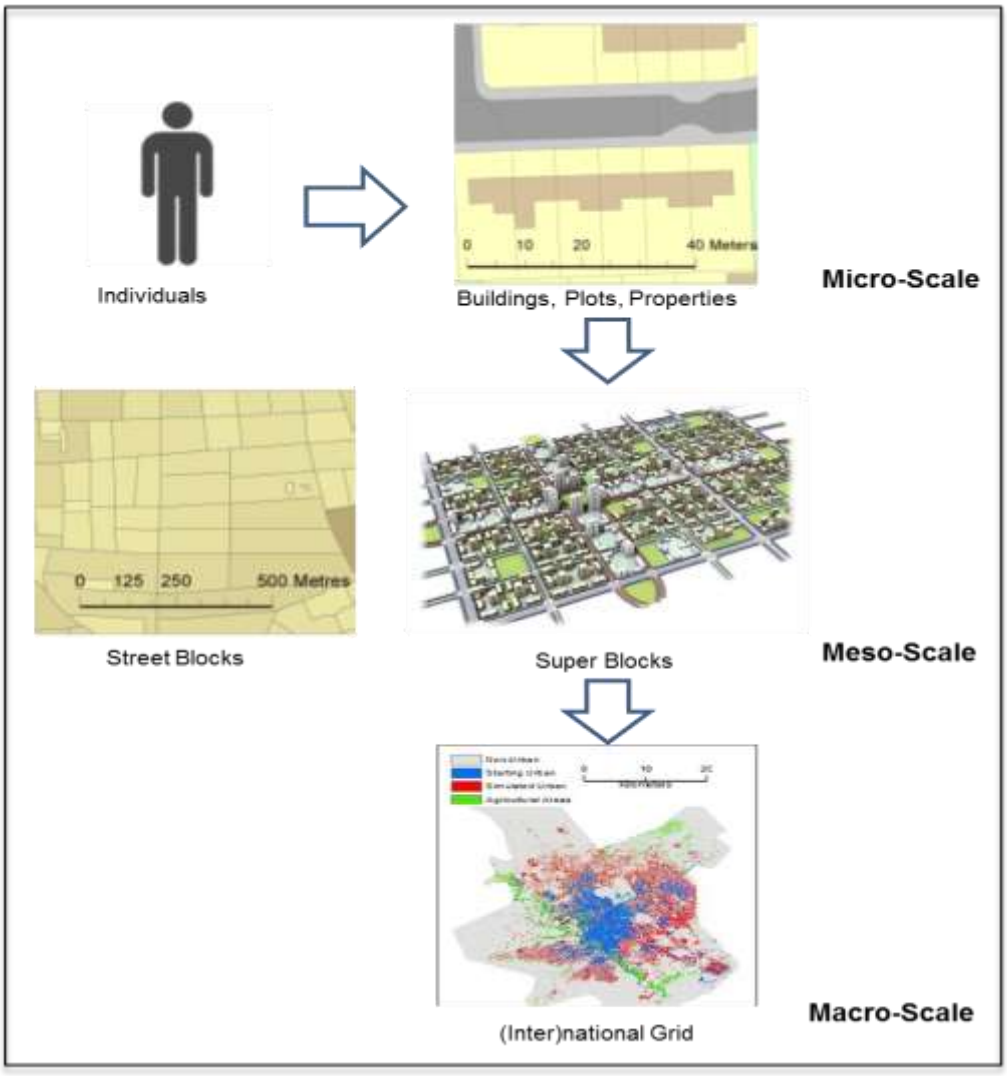


Figure 2.10: Different Scales of Urban Structure (Frey, 1999)

Comparison of a city's urban forms, elements and open spaces must be rationally established according to an accurate understanding of the various scales of the urban forms, without which it would be unreasonable to formulate an appropriate image regarding

the achievements of this city model (Calthrope et al., 2007). A human scale's considerations and development depend on a creative application of the neighbourhood's features and their practical association with the other principles of the district's elements. For example, a significant dimension is that heights of buildings should relate to the rest of the district and building proportions should relate to the size of the human body. This means that mass of buildings compared to their surroundings should not be overwhelming.

2.8 Types and Patterns of Urban Form

Building pattern is the arrangement of existing buildings, their block-plans in the built-up areas, which are viewed as a separate complex element of the city. The block-plan of a building is the area occupied by a building and defined on the ground by its containing walls (Carmona and Burgess, 2001). Azzam (1993, P.15) states that "*the arrangement of buildings, the pertinent feature defining the building pattern is the spatial relation between elements, which is the block-plan and the relations holding between boundaries which must form a closed 'figure' and includes the ground surface within the boundaries*".

The particular form and pattern of a city may owe its shape to a number of factors such as requirements of location, land values, environmental issues and social structure. Using the definition of the urban form discussed previously by Lynch (Lynch, 1994, P. 47), "*the spatial pattern of the large, inert, permanent physical objects in a city"*, it shows that the notion of pattern or shape has been addressed. According to previous discussions regarding the importance of urban pattern and the arrangement of urban forms in the articulation and shaping the city, the choice of the proper configuration concept for a new urban form may have been influenced by attitudes of planners and decision makers (Moughton, 2005). Thus, the literature demonstrates several directions of how urban form maybe analysed, conceptualised and arranged as follows:

2.8.1 According to Intensification

Most researchers and planners have considered issues and patterns of urban forms that concentrate on the intensification of the built environment as preconception studies depending on the earliest modern planning perceptions and concepts. This has occurred due to the increased acceptance among scholars of sustainable urban development as a guiding process (Jenks et al., 2000). The main parameter describing the compactness of urban form of a city is its overall or metropolitan density. Many studies have indicated that the intensity of development in a city has a highly significant impact on urban pattern's mode, structure and configuration (Newman and Kenworthy, 1999). This may be identified in two common concepts:

Compact Form

The main principle in the compact city theory is high-density development close to or within the city core with a mixture of housing, administration and commercial buildings (Figure 2.11). The supporters of the compact city theory (Jenks, Burton and Williams, 1996) believe that the compact city has social, environmental and energy benefits. The list of advantages is remarkably long, including a better environment, land preservation, affordable public transport, social diverse and a higher quality of life (Jenks and Jones, 2010). Dantziq and Saaty are amongst the first who have made an effort to define the Compact City. They give the main features of the intensified urban forms as follows: highly-dense settlements, less dependence on automobiles, clear boundaries with surrounding areas, spatial characteristics, mixed land use, diversity of life, clear identity, social equity, self-sufficiency of daily life, and independence of governance (clear boundary) (Dantzig & Saaty, 1974).

However, the list of arguments against the compact city theory is even longer and includes: the rejection of suburban and semi-rural living, the neglect of rural communities, the reduction of green and open space, the rise in congestion and segregation, the decline of

environmental quality, less social privacy, other security considerations, and diminishing power for making local decisions (Frey, 1999).

Figure 2.11: Compact Core in the City Centre of Tokyo-Japan (Suzuki et al., 2013, P.65)

Urban Sprawl

Many scholars and planners have debated the urban form of sprawl. It may be defined as the rapid and uncoordinated growth of urban low-density settlements at their urban fringes, associated with automobile-oriented development and sustained economic growth, and the cultural qualities of life styles in our society (Talen, 2011). The spatial separation of land uses have improved living conditions markedly for residents by reducing air pollution, improving health through new regulations designed to work against overcrowding, as well as creating comfortable and predictable suburbs for residents to live in (Figure 2.12). These forms are typically associated with patterns of a clustered, linear-organic type of streets, non-traditional small centres, large sizes of green and open spaces, and detached and fragmented housing types.

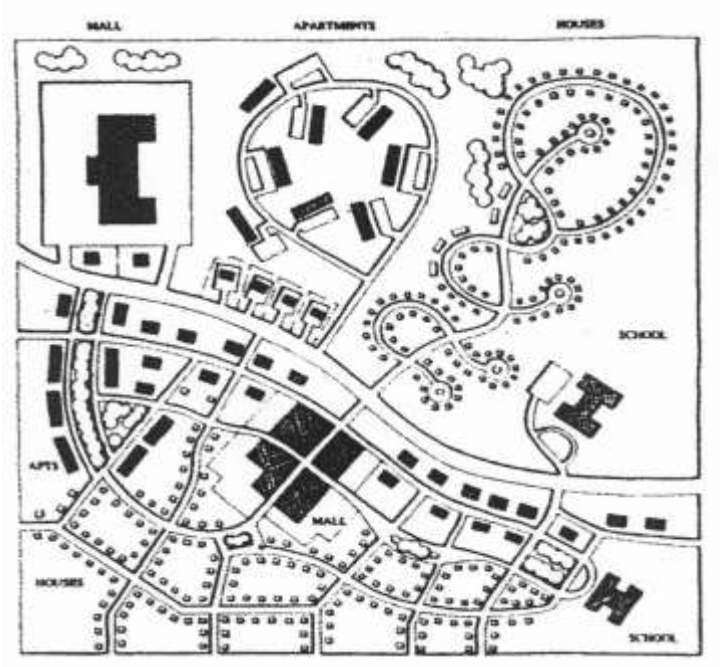


Figure 2.12: Traditional Suburban Sprawl in the UK (The Urban Task Force, 1999, P.24)

Contradictions and criticism have been presented against this approach by many scholars and planners. Newman and Kenworthy believe that urban sprawl is responsible for higher energy demand in general and in the transportation sector in particular because of the increase in miles that vehicles have to travel to reach daily services, facilities and other destinations (Newman & Kenworthy, 1999). Anderson claims that there are three main concerns related to urban sprawl: the rate at which it is consuming the landscape, the air pollution that such a high level of automobile reliance is causing, and unsustainable social cohesion (Anderson et al., 1996).

2.8.2 According to Pattern and Configuration

The planning for sustainable urban development requires the application of a new paradigm for both urban transport and a new urban form. Many studies have defined urban form as the spatial organisation of urban elements in the city. This includes the spatial pattern of land uses and their densities as well as the spatial design of transportation networks (Moughtin and Shirley, 2005). Accordingly, there is a growing body of research concerned

with how urban forms are spatially arranged depending on how urban blocks are characterised and configured along with transportation structure.

Urban planners, however, should constantly monitor the impact that specific policies may have on city shapes. They should be aware of the effect of the most common planning tools, land use regulations, infrastructure investments and taxation on the spatial organisation of a city (Bertaud, 2004). Many patterns and urban structures are available in the literature for close study as follows:

Concentric Pattern

A centralised organisation is a stable, concentrated composition that consists of number of secondary spaces (buildings) grouped around a large, dominant, central space (an important building, a square or plaza) (Figure 2.13).

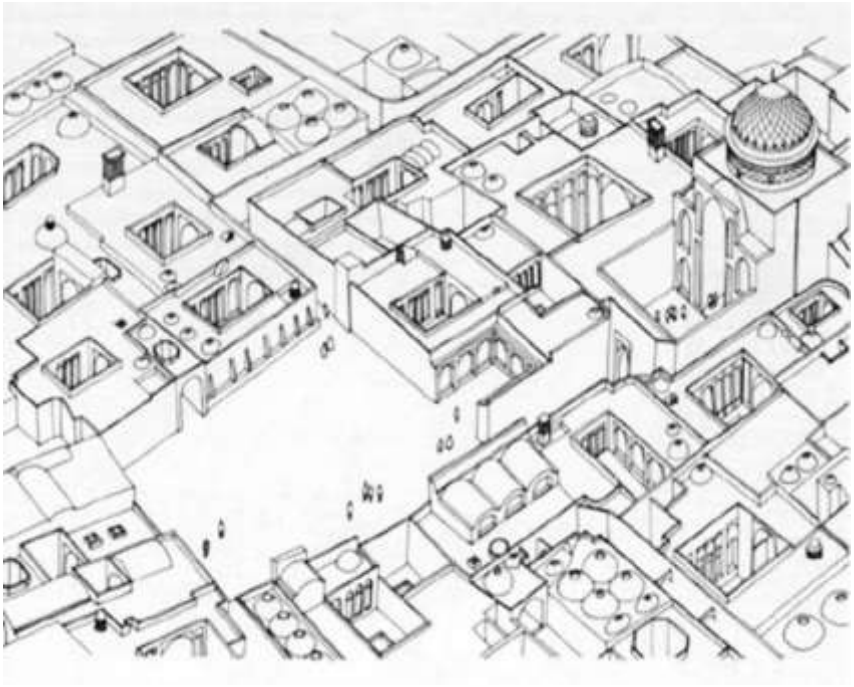


Figure 2.13: Central Plaza, Traditional Arabic City (Azzam, 1993, P. 33)

This type of arrangement reflects extension or development from the central location outwards. The centralised urban form appears to be a most useful model for new sustainable town developments of limited extent. The size of the development from centre

to periphery should be about half a mile to 1000 meters. In a town of this size it is a 10-minute walk from the periphery to the centre (Moughtin and Shirley, 2005, Ching, 2007).

Linear Pattern

A linear organisation consists essentially of a series of spaces (buildings). These spaces can either be directly related to one another or be linked through a separate and distinct linear space, street or path of movement as in figure 2.14 and 2.15.

The linear form can be segmented or curvilinear to respond to topography, vegetation, views or other features in the site. They are more usually a product of the industrial revolution and most closely associated with the metaphor of the industrial city (Marshall, 2005). The main feature of the linear urban form is its ability to deal with the rapid and efficient mass movement of people and goods within and between cities and a very strong visual image. A further quality of the linear structure is its ability to obtain and extend with infinite growth (Moughtin, 2003).

Figure 2.14: Linear Pathway, Wolverhampton, UK (R. Ibrahim)

Figure 2.15: Concept of Linear Pattern

Radial Pattern

A radial organisation of space combines elements of both centralised and linear organisation. It consists of a dominant central space (plaza or building) from which a number of linear organisations (strips of buildings or green spaces) extend in a radial manner. Radial rings incorporate the elements of radial and ring/ concentric design (Figure 2.16 and 2.17). This type of arrangement gives axial and visual direction to the centre (an important node, feature or landmark), the increased intersections of streets and heavy flow of traffic in the centre is the main argument against (Marshall, 2005; Ching, 2007).

Clustered Pattern

A clustered organisation relies on physical proximity to relate its spaces (buildings) to one another. It often consists of repetitive, cellular spaces that have similar (or different) functions and share a common visual trait such as shape or orientation (Figure 2.18). This type of arrangement may consist of a group of buildings around an open space (court yard) or an essential building to give it prominence (Ching, 2007; Pont and Haupt, 2009).

Figure 2.16: Central-Radial Pattern Bilbao City, Spain (Carmona and Burgess, 2001, P.49)

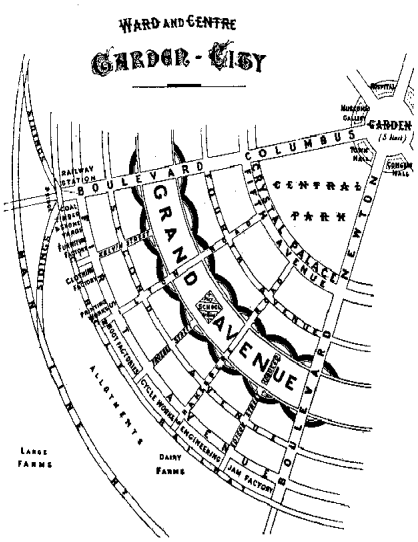


Figure 2.17: E. Howard, Garden City (Mumford, 1989, P.426)

Figure 2.18: Clustered Residential Complex, Malmö-Sweden (City of Malmö, 2008)

Some urban form packages imply functional correspondences. Polycentric structure, for example, implies functions spread over an urban region in relatively dense nodes or clusters. Similarly, the distinctions between mono-centric and multi-centric or decentralised cities, or between central cities, satellite cities and urban villages, are more than matters of physical arrangement, but imply functional relationships (Marshall, 2005).

Grid Pattern

There is a fundamental relationship between urban form and pattern of the street (Figure 2.19 and 2.20). It seems, therefore, that the grid plan, in the way it was developed in the 1960s as a means of accommodating the motor car, is inappropriate for fulfilling the goals of sustainable development (Moughtin, 2003). The traditional grid structure has proved, in the past, to be a most sustainable form surviving many centuries of development and redevelopment (Santamouris, 2006). Grid organisation consists of forms and spaces whose positions in space and relationships with one another are arranged of a systematic grid pattern (Ching, 2007). The grid plan can take many forms like: the directional grid, the

triangular grid, the grid as a hierarchy of boxes, and the grid as a strict orthogonal geometrical figure, often called a grid-iron plan (Lynch, 1984, Marshall, 2005).

Figure 2.19: Grid Blocks of Barcelona, Spain (Llatzer, 2008, P.38)

Figure 2.20: Lucca, Italy the Roman Gridiron (Moughtin, 2003, P.156)

2.8.3 According to Centrality Relationship (The Macro Structure)

As previously mentioned, a number of publications describe different city forms and structures and their characteristics. The following discussion of urban form does not focus on details of form of spaces and buildings, but dynamic patterns. City form must accommodate such changes of structures and patterns without loss of the city's overall viability, identity and imageability (Lynch, 1984). This leads to enormous microstructures with a hierarchy of different provision centres and different linkages between them. It is now important to compare these approaches that provide other qualities which depend upon the city's overall form and development pattern within like: various typologies of housing forms, quality environmental conditions, flexible adaptability to socio-economic requirements, better permeability to public and open spaces, and high accessibility to suburban areas (Frey, 1999).

The Core City

This concept is equivalent to the mono-centric and compact city where all heavy employment, administration and transportation activities are located within the centre of the city in the form of high density arrangements (Frey, 1999). Lynch suggests that "*owing to the compactness, the extension of the built-up area of the city would be relatively small in comparison with more fragmented models discussed later*" (Lynch, 1984, p. 373). Distances between working places, facilities and residential locations are short. Heavy industrial and other equivalent activities are placed at the edges of the city. Main common arguments against are the high level of pollution, extreme land and property values (Figure 2.21)

The Star City

The star shape has been the basis for a number of city plans, sometimes very successful. According to the advocates of this theoretical approach to urban planning, the star is the best form for any city of moderate to large size (Moughtin, 2003). The star city has a single dominant centre which is occupied by high density activities and comprises a mix of land uses (Marshal, 2005). A number of main transportation routes radiate from this centre. Along these routes, sub-centres of smaller densities are located which contain less intense structures (Figure 2.22).

The main radials become overloaded with continuing growth of the star. Connectors are used as secondary roads to reach the radials through sub-centres. The main problem is the overcrowding of population and activities along the main roads. This decreases access to services between inner and outer locations (Barton, 2002). Copenhagen is considered one of most important classic realisation of this idea (Figure 2.23).

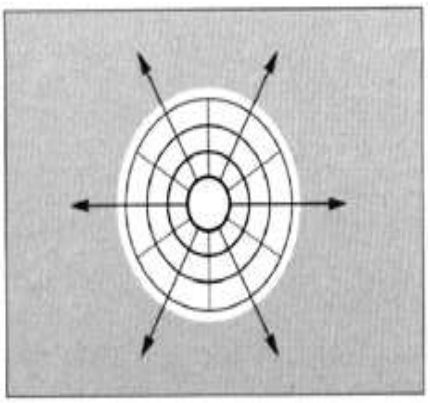


Figure 2.21: The Core City

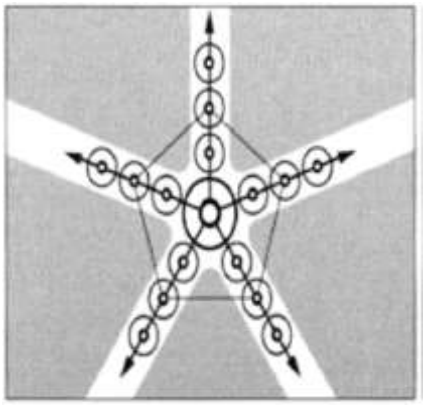
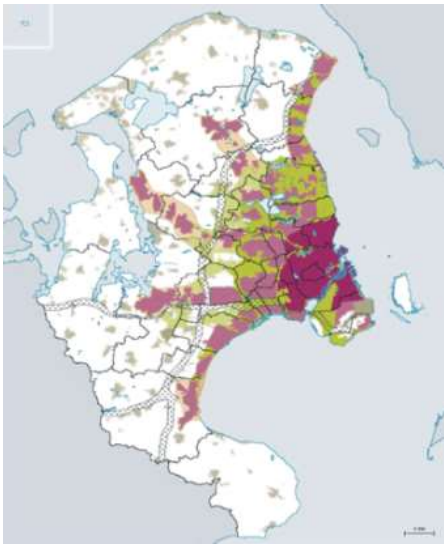


Figure 2.22: The Star City

(Frey, 1999, P.58)



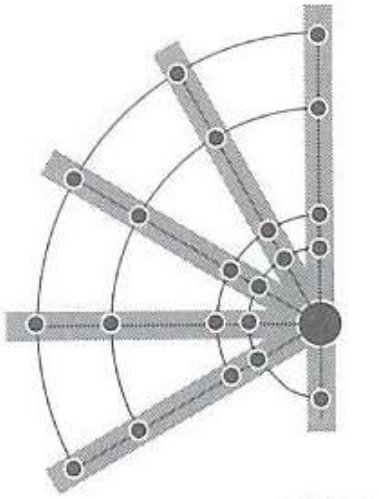


Figure 2.23: Copenhagen's Finger Plan 1983 (Barton, 2002)

The Satellite City

In the satellite city model, a central city is surrounded, at some distance, by a set of satellite communities of limited size (Figure 2.24) (according to Lynch the optimum population of a satellite is between 25,000 and 250,000 inhabitants). The main central city contains the core of activities, administration, and commercial functions. The growth of the central core is channelled into separated equal communities with smaller facilities (Lynch, 1984). One of the main arguments against is the limited expansion outwards. Major developments take place around the centre in order to preserve the greatest amount of green spaces around (Marshal, 2005). The Satellite concept has perhaps been the most influential of all the city

models, similar to Ebenezer Howard's Garden City, and appears frequently in planning proposals in many different situations (Haughton and Hunter, 1994).

The Galaxy of Settlements

Galaxy of settlements represents an urban or metropolitan form in which the main centre and sub-centres are dispersed into small urban communities as the result of continued decentralisation. Each community includes its own central core of high- density activities and they are linked by systematic transportation lines (Figure 2.25).

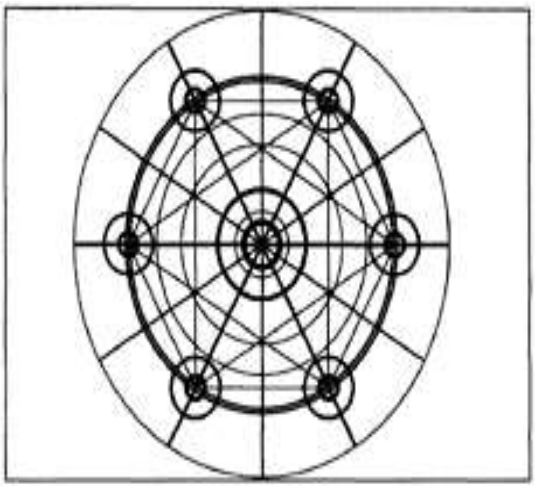


Figure 2.24: The Satellite City

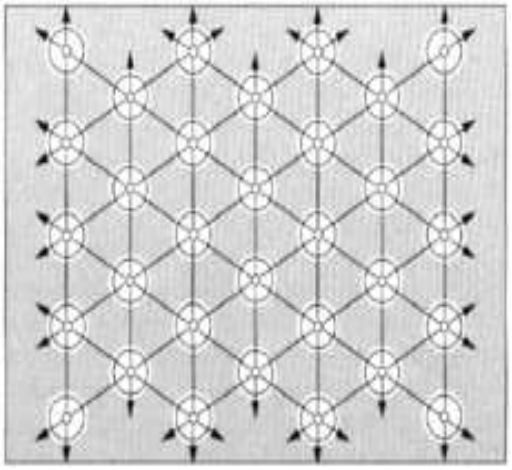


Figure 2.25: The Galaxy Settlements

(Frey, 1999, P.59)

This concept resembles the traditional neighbourhood developments of small size of about 80 ha inhabited by between 3000-6000 people. The distance from edge to centre is about 600 m. (10 min. walking) (Frey, 1999).

The Linear City

This type, known as a ribbon or strip development, is characterised by concentration of development along both sides of major continuous transportation routes such as roads, inner rivers or other forms of transport network. The linear city is compact but has no central core where there is relatively equal access to services, working plots and open land, through areas between transport nodes (Marshal, 2005). One of the major arguments against is that this form of development requires massive investment in efficient public

transport and related infrastructure and may become effective and economically viable only in the form of cross-city links (Minnery, 1992). One well-known example is the linear development in Madrid planned by Soria y Mata to serve suburban districts (Figure 2.26).

The Polycentric Net or Regional City

This form redirects development away from the urban core or city centre toward recognised urban growth areas or nodes with a specialised and complex connection system adopting the form of a triangular grid pattern that can develop randomly (Marshal, 2005). The major centre provides main facilities and services to its nodes and acts as its external linkage to other centres of the city. Furthermore, the variety of centres offers various life conditions and choices (Figure 2.27).

This form includes different densities, intensive at the centres, junctions and the major transportation. Inside the grid, medium and low densities are located near the cores and between movement networks (Lynch, 1984).

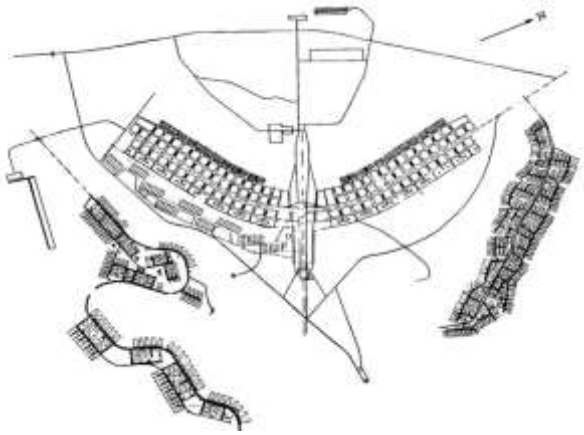


Figure 2.26: The Linear City of Soria Mata (Moughtin, 2003)

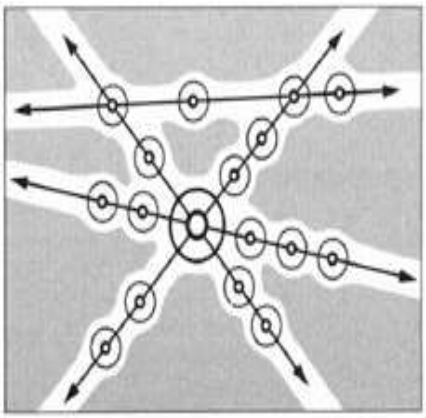


Figure 2.27: The Polycentric Net (Frey, 1999, P.60)

2.8.4 According To Urban Growth and Nodality

Developing cities show a variety of spatial development patterns according to the historical phase in which major growth waves occurred. From a physical perspective, the relationship between the central-core zone and the type of future urban development is the main

concept for this type of urban node-corridor growth (Grosvenor, 2013). Modal urban systems of this pattern are identified by rings which refer to urban development zones, the circles are the facilities and activities within the urban area, and the rings clarified by shading that show zones of urban development, circles are activity nodes and shading specifies future urban expansion (Newton et al., 1997). Planners and scholars have investigated and proposed growth patterns for cities recently. Six of the most common urban form developments or current growth patterns are indicated as follows:

Dispersed Settlement

This type of arrangement shows horizontal development with sub-centres and connected transportation. Vehicles are the main transport mode while transit systems have improved to service specific needs (Figure 2.28). It represents a context of low level of density and centrality where development is oriented along highways (Cervero, 1998). This concept reflexes an outward expansion of urban development at relatively low densities (10–30 persons per hectare), dominated by a central city (as the key economic node), and associated multi-nodes and sub-centres which are connected with local bus services (UNEP, 2011).

Compact Growth

The growth accommodates increased population, activities and network of the city centre. These types of patterns typically have strong, compact and centralised urban cores, with overcrowding downtown which is connected to residential areas by the transit corridors (Newton et al., 1997). Furthermore these central urban areas are accessible to public transport, employment, retail and essential services with a mixture of housing choice (Figure 2.29).

Edge city

It consists of holistic growth in a sub-centre linked by orbital public transportation, growth in population, housing density and employment at selected nodes, and increased investment in freeways linking these nodes (Grosvenor, 2013). Dense, random and close, orderly blocks are two common construction patterns and are the main theme of the buildings in this development (Figure 2.30). A proposed public ring road (freeway) contains the main periphery nodal-centres and connects them to the CBD (Newton et al., 1997).

Corridor Expansion

This pattern is similar to the radial system which has been mentioned before, depending on developed networks emanating from the centre to the peripheries and supported by upgraded infrastructure (Figure 2.31). They have a high level of density and centrality where development is oriented along transit lines and stations. Urban transit is the dominant mode of mobility and the urban landscape is adapted to facilitate networks' general needs (Cervero, 1998).

Fringe City

Growth and development concentrate on the suburban and peripheral regions (Figure 2.32). The core maintains to supply the sub-centres and connect with appropriate transit. Mobility between fringes and other settlements is of high quality, while the level of density remains near to the central core (Pressman, 1985). New manufacturing and service industries are also distributed to these same zones and in the same proportions, providing a balance between places and spaces (Minnery, 1992).

Ultra Regions

This is almost like a dispersed city, but represents an updated solution to the problem of the future viability of many developed provincial cities. Growth expands in the regional centres within 100 kilometres of the main centre (Figure 2.33). Public transport, like high speed

rails, connects the centres to the main CBD (Cervero, 1998). The CBD and sub-centres are high-intensity blocks serviced by main transit lines where secondary lines connect them.

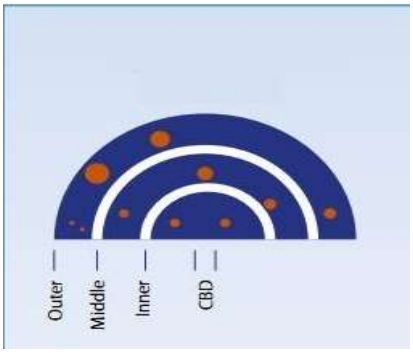


Figure 2.28: Dispersed City

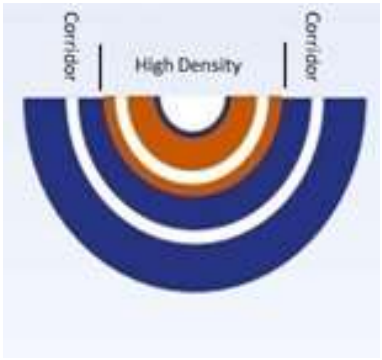


Figure 2.29: Compact Growth

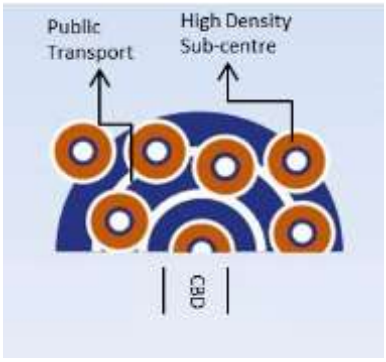


Figure 2.30: Edge City

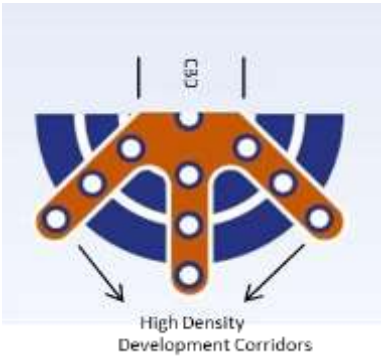


Figure 2.31: Corridor Expansion

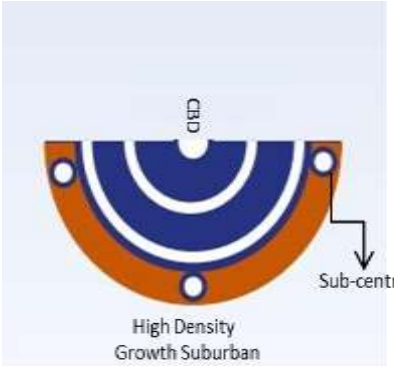


Figure 2.32: Fringe City

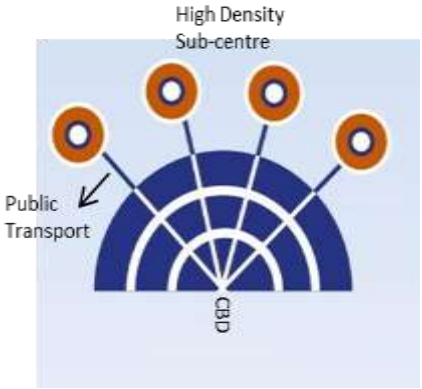


Figure 2.33: Ultra Regions

Spatial Arrangements According to Urban Growth (Newton et al., 1997)

2.8 Summery

This chapter has explored the importance of modern and neo-liberal urban forms in the age of accelerated urbanisation and population growth. It summarised briefly the historical background of the urban form in several distinct eras. Holistic definitions and clarifications of urban forms and their elements have been demonstrated. The chapter focuses on and emphasises most the numerous types and approaches of spatial patterns of urban form, their qualities and application, and how they have been reviewed and classified by an enormous amount of literature. The classification shows that the urban form can be understood from different points of view depending on many factors like: the type of development, the transport system, the size of the population and city, and sustainable urban form requirements.

The next chapter intends to focus on the thematic approach of the study and the main issues that related to urban forms in the developing countries.

Chapter 3: The Thematic Approach

3.1 Introduction

Chapter three is a thematic approach towards the definition of the research problem. It is composed of two interrelated parts. The first describes specifically the enormous issues and concerns which are widely related to the urban form. The second part addresses urban form problems in global and regional context.

3.2 Problems and Issues Related to Urban Form

Exploring urban forms has always been a subject and interest of scholars, urban designers, and geographers. The importance of urban forms has been widely discussed recently. However, academia and urban managers have identified urban forms as the root for the city's physical, social and environment problems (Newman & Kenworthy, 1999).

Increasing debate on issues of urban forms has led to the consolidation of urban physical, social and environmental agendas, and the definition of a specific body of problems and policy issues. Many human settlements, while designed, built and inhabited by humans, fail to provide an appropriate built environment for human interaction and community life (Farr, 2008). Planners and other experts have individualised specific problems to account for the increasingly frequent lack of congruence between human needs and the design of urban areas. Loss of public space, lack of human scale, scarcity of places for social interaction, too-low densities, and emphasis on isolation, individualism and self-protection are censured as the main causes of the overall loss of urban quality (Ruano, 2009).

Accordingly, there are many issues and concerns related to the urban form context that have been investigated by many scholars and much literature. These issues are practically interrelated and have been referred to as the main pillars of urban form's problem context. These challenges can be addressed as follows:

3.2.1 Land Use

The term “land use” indicates the human occupation of land which affects inhabitants’ patterns of movement and transportation, social and economic values, living and health issues, and all other related factors. Furthermore, Mohareb (2009) states that land use concerns the function or purpose for which the land is used by a population and can be defined as the human activities which are directly related to land, making use of its resources or having an impact on them.

It is important to increase more relevant debate about the conceptual roots of urban form and land use development issues to formulate a holistic and progressive framework. However, prosperous lifestyles and wasteful use of land, both in developed and developing countries result in an unequal use of resources and urban forms that is often unmanageable (Jenks et al., 1996). In addition to that, the scale of land availability offers opportunities/constraints to the adaptation of the land use pattern. This last factor can be seen to have a direct link with urban form but the others are more indirect with the exception of the revenue component of development appraisals (Jones and MacDonald, 2004). Finally, urban development challenges which are related to land use have been significantly identified by UN-Habitat (2009) as follows:

–Increased land fragmentation in densely populated areas.

–Unequal land distribution (Figure 3.1), land degradation and inefficient land use.

–Unsustainable management increased activity in land rental markets.

-Geographical and environmental land poverty.

The proper relationship and development between urban forms, their pattern and land use in the planning policies, has become an essential indication in the recent sustainable urban development.

Figure 3.1: Land Use Distribution, Buenos Aires (Carmona and Burgess, 2001, P.72)

3.2.2 Transportation

Urban forms and transport have been identified as two related fundamental aspects of sustainable cities by many researchers and scholars. They have noted that cities actually function as a series of interlocking systems in a hierarchy of urban settlements which are connected with a network system of transportation. The spatial arrangement of buildings is considered to have as large an impact as the character of the transport system itself.

The invention of transportation systems such as underground trains, suburban railways, trams, motor cars and buses dramatically altered the distances that could be covered, and thus helped create remote fringe settlements (Vale and Warner, 2001). Consequently, the expanding demand for different urban transportation has put a significant burden on the environment, economies and the quality of life in most rapidly growing cities (Suzuki et al., 2013). Many scholars and a considerable amount of literature have addressed and focused on the issues of transportation related to the city and urban form. For example, there is general agreement that current levels of car use (Figure 3.2), fuel consumption, congested city streets, emissions, the unplanned and uncoordinated nature of the rapid expansion of

the urban periphery are unsustainable in many parts of the globe. Therefore, the relationship between travel patterns and the physical forms of cities is considered an important issue to be traced thoroughly (Grierson, 2000). In particular, most of the research and inquiries have concentrated on the appropriate urban forms to facilitate sustainable transport solutions. Taniguchi et al. (2005, P.140) suggests that " *decreasing trip lengths and times, reducing reliance on the car, enabling efficient public transport, encouraging walking and cycling and reducing transport-related emissions, pollution and accidents, are among these solutions*".

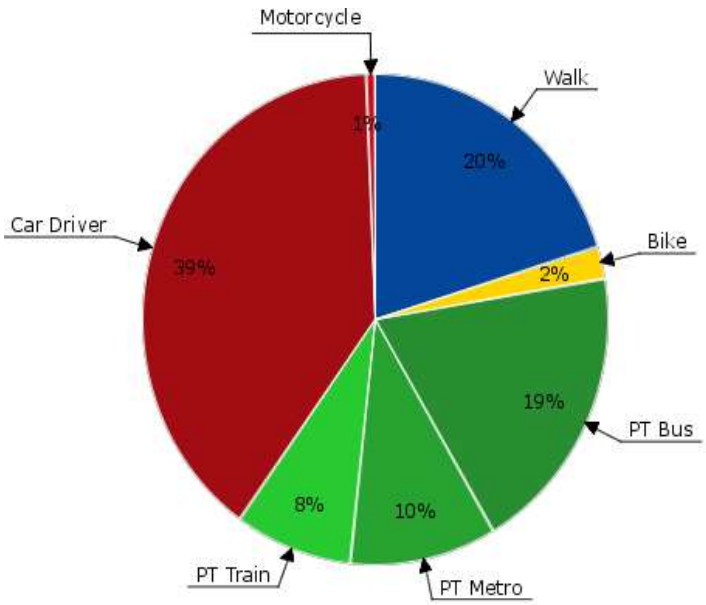


Figure 3.2: Transportation Rate in London (Rode et al., 2011)

3.2.3 Densification

Density has remained a central concept in planning, architecture and urban design both in developed and developing countries. The concept is widely used to express urban morphology, urban form, and to estimate the carrying capacity of new and old development in terms of social and physical infrastructure (Jenks and Dempsey, 2005). Urban intensification is commonly defined as a process whereby new buildings in cities are built at higher densities so vacant land in urban areas is developed (Dave, 2008). Closely linked to density is overcrowding, which implies too many people are living or working in a given

neighbourhood, plot, dwelling or room. It should be noted that there is an important difference between higher housing density and crowding. It is possible to have high density of housing without crowding. In this sense, many scholars have asserted on the densification, overcrowding, and their various related issues. Jenks & Burgess (2004) believe that overcrowding and densification of buildings are probably one of the major negative policies which affect housing markets and land containment. Therefore, many cities are now rapidly expanding outward consuming bigger quantities of land (Sorensen et al., 2011).

By encouraging high residential densities that can reduce the pressures on land in countries experiencing rapid population growth urbanisation could reduce the scale and severity of environmental impacts. Newman & Kenworthy (1999) have argued that the densification of the built environment decreases urban sprawl and controls both resource and energy consumption by reducing the role of the car, encouraging public transportation and promoting a walkable community (Figure 3.3).

Figure 3.3: Urban Density, Notting Hill, UK (Rogers and Power, 2000, P.276)

However, although historically the proportion of land converted into urban uses has been small, a relatively recent and significant trend is emerging in both developed and developing countries around the world. Case studies in Brazil, Curitiba for example, have shown that government policies, plans and development control instruments can shape cities and densities, linking public transport, land use and housing development in an intelligent densification strategy which optimises infrastructure, municipal services, land and public resources (Sandroni et al., 2011).

3.2.4 Urban Size

It is expected that the majority of future population growth will take place in urban areas. Africa, Asia and Latin America will host approximately 90 per cent of the added urban population (UN, 2014). The urban transition occurring in the global south is dramatically different from that which occurred in Europe and North America in the first half of the 20th century (Yang, 2010). Describing recent trends in urban growth, Cohen (2004) highlights the main points of divergence in the developed and developing country as follows;

- The scale of change is unusual, with both the number and size of cities increasing rapidly.
- Urbanisation is occurring more rapidly than at almost any other point in history.
- Urbanisation is taking place in countries that have lower levels of income (Figure 3.4).

Consequently, Fragkias & Boone (2013) argues that the common range of public services, utilities and social services which are provided in the cities of developed countries are not generally available to the citizens of most of the cities of developing countries. Far more, it has been warning that smaller cities in the developing countries may not have the resources to provide healthy, financial support, and well-functioning systems to contain the unprecedented growth.

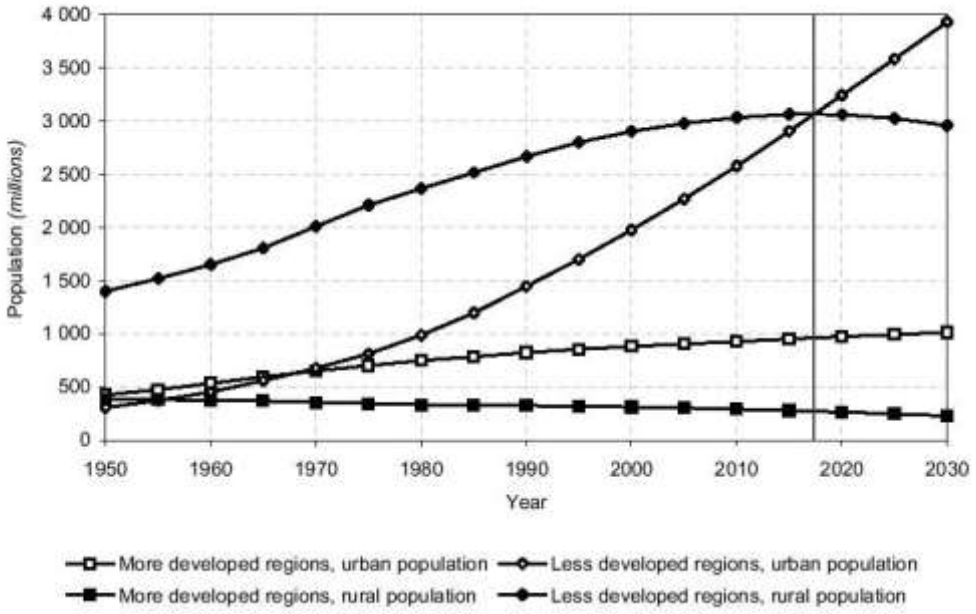


Figure 3.4: Urbanisation in Developed and Developing Regions (UN, 2014, P.7)

In the developing countries, the staggering housing problem involves the shortage of affordable dwellings for the low-income majority in urban areas. This has resulted in the construction of illegal settlements in many cities like Cairo and Delhi (Jenks et al., 2000). Ghadami (2012, P.135) indicates other issues related to urban growth and urbanisation. He highlights that "*Increasing growth of urbanisation has led to an increased need for more space and more movements that finally have resulted in urban spatial change, in the form of physical expansion or decentralisation. Such changes could have significant effects on the quality of urban development process*".

3.2.5 Environmental Impact

One of the greatest challenges that the world is facing today is climate change which refers to the variation in the earth's global environment over time. As cities develop, they undergo an environmental transition associated with changes in the types of environmental challenges and their associated risks as well as the spatial scale of the impacts. Therefore, the dominant environmental issues that a city faces generally change with growing

affluence (Holden, 2004). Scholars have mentioned many environmental issues related to urban form. Barton (2002) discusses that recently cities mostly face problems caused by environmental damage and depletion of non-renewable resources and rising levels of pollution; direct and indirect emissions of (GHG); unsustainable consumption; degradation and wasteful use of resources; and inadequate sanitation and water supply.

Urban form may have a variety of other energy and environmental implications. Most of the new directions in urban planning which are considered in achieving long-lasting cities demand compactness, diversity, and dense layout. These aspects were the main characteristics of our old cities and neighbourhoods which usually had a dense form, mixed uses, and were well protected environmentally (Figure 3.5).

Figure 3.5: Traditional Urban Form, Fez, Morocco (Azzam, 1993)

For example, the compact residential districts of traditional Islamic cities, which were associated with a high-density urban form, might have lower energy requirements for space conditioning and lighting than those of a more dispersed city. This design affects the form of the built environment through, for example, the orientation of buildings and urban densities (Thomas, 2002; Jabareen, 2006).

3.2.6 Social Consequences

The claims about the impact of urban form on social sustainability are complex and include many significant issues of quality of life, inhabitant's behaviour and social equity. Scholars and literature have divergent attitudes regarding the proper urban form concept, which raise a number of key questions for the researchers. The Urban Task Report (1999), for example, believes that higher densities and mixed use urban forms will provide a better quality of life due to more social interaction, community spirit and cultural vitality. Jenks and Burgess (2004) assert this approach and add that having a diversity of uses and the appropriate accessibility nearby is also seen as a key to achieving social equity. However, Breheny (1992) has a contrary vision when he claims that intensification leads to negative impacts such as less social privacy, poorer access to green spaces, lower health quality, less living area and less affordable housing (Figure 3.6).

Figure 3.6: Social Life in Indian Slums (Cronin, 2011)

It is obvious that there is no single answer, as benefits (or costs) depend on the type of urban form and its social context. Williams (2005), for example, argues that while inner city mixed use areas might achieve the benefits of more social interaction and vitality, and better access to facilities, they also could suffer from social pressure, fear of crime and the effects of social injustice. Whereas in suburban residential areas, the quality of life may be

enhanced by access to green spaces, better social contacts and more safety and security, but less access to facilities (Masnavi, 2011).

In addition to previous issues, UN Habitat (2009) discusses other significant social phenomena. For instance that in many parts of the world, in the developing countries particularly, fear of crime has increased urban fragmentation as middle- and upper-income households isolate themselves into 'walled or gated communities' and other types of controlled residential complexes. Moreover, in many developing countries, spatial forms are largely directed by the efforts of low-income households to secure land that is affordable and in a location close to employment and other livelihood sources. This process is leading to entirely new urban forms as the countryside itself begins to urbanise (Sandroni et al., 2011).

3.3 Urban Form in the Global Context

Urbanisation will be the common trend over the next several decades, especially in developing countries, where the bulk of extreme poverty is concentrated. Urbanisation is defined as a process of relocation and settlement of population from the countryside to towns and cities. Cities are responsible for the bulk of production and consumption worldwide, and will play a central role in the ability of nations to achieve sustainable development. In one hand, today, half the world's seven billion people live in cities (figure 3.7). By 2030 there will be over one billion more urban residents (UN Habitat, 2010). Between 2010 and 2050, the urban population will grow significantly, between 2.5 and 3 billion people (Bertaud, 2004). Urbanisation has the ability to transform the social and economic fabric of nations. Roughly, three quarters of global economic activity is urban. Therefore the right to development for low income and middle income countries can only be realised through sustainable urbanisation that addresses the needs of both rural and urban areas (Suzuki et al., 2013).

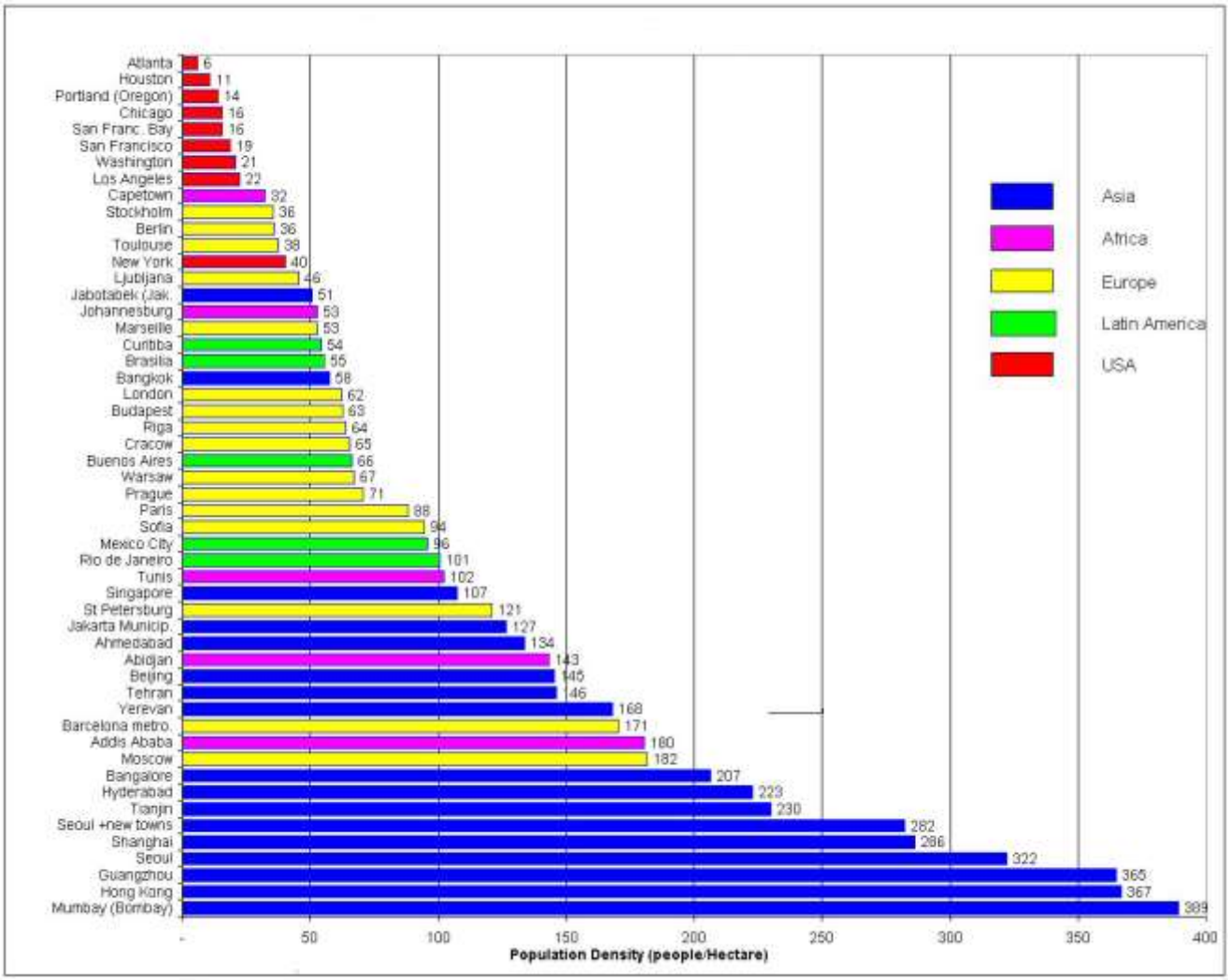


Figure 3.7: Average Population Densities in Built -up Areas in 60 Global Metropolitan (Bertaud, 2004, p.153)

High demographic growth, low levels of economic development, high income inequalities, small urban budgets and shortages of environmental infrastructure, shelter and basic services have a critical effect on urban development policies and the effectiveness of policy instruments (Pitts, 2004). These policies and strategies may require new urban forms of different land-use plans, technologies in infrastructure provision and transport strategies. However, the failure of political and economic development can lead to deterioration in all other aspects of sustainable urban development (Satterthwaite, 1999).

3.4 Urban Form Issues in Developing Countries

Recent years have brought an enormous addition in the literature on urban forms in the developing countries and rapidly growing cities in particular and how urban development can meet human needs and ensure long-lasting cities. Scholars and literature have discussed continuously various issues related to urban forms in these regions.

Cohen (2004) indicates four important factors which make the experience of urbanisation in developing countries different from that of developed ones as follows: the higher rates of population growth; the declining available agricultural land in some countries; the lower costs of transportation and communication which accelerates migration; and the more limited international migration. Kaji argues that the management of urban form is difficult in developing countries due to the economic value involved and building new cities with new trend forms is an undesirable solution in these countries (Kaji et al. 2003). Jenks and Jones (2010, P. 5) emphasise the idea when they add "*To achieve the sustainability goals in developing countries, the policies of compaction are more appropriate at the regional and metropolitan scale*".

Furthermore, in large cities in developed countries sprawl urban form has dominated and been fuelled by middle-income homeowners (Figure 3.8). In contrast, a large part of the development on the periphery of large cities in developing countries consists of relatively isolated and poorly serviced low-income settlements. These remote neighbourhoods increasingly attract poor migrants who are unable to find affordable shelter in more central areas (Jones et al., 2004). Sorensen adds more and believes that urban forms in most growing cities in developing countries are inefficient and devastating the built environment. Furthermore, government agencies are aware of these problems and adopting strategies to provide more unsustainable urban forms which have potentially negative impacts on the current urban development (Sorensen et al., 2011).

Under these conditions, developing countries need to adapt extensively progressive strategies to be able to sustain their developmental growth, even if their development includes substantial improvements. These outcomes may form prerequisites for future major housing projects to show that they are consistent with expectations outlined in established strategies, with government agencies recognising the importance of encouraging development that achieves acceptable social, economic, physical, environmental and consequently political objectives (Rydin, 2010).

Iraq has witnessed three international wars: the Iran-Iraq war 1980-1988, the Gulf war 1991, and the political change in 2003. They have led to a gradual decline in the quality of its built environment. Among all the problems related to the built environment that Iraq is currently facing, perhaps the most significant is impending urbanisation (Figure 3.8).

Figure 3.8: Urbanisation in the Middle of Baghdad City, Iraq (Ministry of Housing and Planning)

All cities and urban areas are rapidly growing in terms of both geographic and population size. Thus, more than half of the country's population is now living in urban areas. Most of these presumed areas though are called urban, but they lack the appropriate services, facilities and urbanised activities. When one examines most of the literature written on

urban and housing problems in Iraq, it is possible to identify problems facing cities, such as problems linked to urbanisation. Aladhami (1975) discovers that four issues have perhaps generated the most concern, as follows: the rapid urban growth and rapid rates of urbanisation; the overconcentration of urban population in the major cities; Baghdad, Basra, Mosul and Erbil; the shortages of housing and community facilities and services, particularly in the large cities, and social problems, such as family disorganisation and crime.

3.5 Summary

This chapter has addressed the research problem context globally and locally. First, it describes the global issues in the developed countries related to the urban form and the spatial patterns of the built environment. The chapter identifies the most significant urban issues the related to urban forms in the developed and developing countries in general and Iraq in particular.

The next chapter 4 is the definition of the sustainable urban form notion as it has been addressed in the available literature. The chapter presents holistically the main concepts and approaches related to the sustainable urban form to derive the essential characteristics and aspects which are related to the spatial patterns of urban form.

Chapter 4: Sustainability and Sustainable Urban Forms

4.1 Introduction

This chapter is devoted to exploring the context of sustainable urban form. It reviews the main aspects and core of sustainable urban development in general and focuses on the physical characteristics in particular. In order to secure sustainable pathways for urban development and constitute a holistic vision of a paradigm of urban patterns and sustainable urban forms, the chapter describes substantially the enormous approaches and concepts of sustainable cities and neighbourhoods. These essential studies and concepts are illustrated and supported by various related global examples.

4.2 Sustainable Urban Development

The world is in the midst of a disturbing period of growing consumption, population, and environmental deterioration. From global warming to biodiversity loss to patterns of sprawling land consumption, the environmental trends are increasingly dire. Naess (2001) and Santamouris (2006) thus, suggest that cities in both developing and developed countries are involved and seen to be important in the realisation of sustainable development. He adds that there seems to be widespread agreement that solving global issues means the adoption of appropriate policies and programmes that lead to sustainable development. Riddell (2004, P.15) states that "*Sustainable development recognises that sound economic and social development is not possible without a healthy environment and progressive institutions*". Accordingly, it seems that sustainable development is a debatable concept and it continues to raise a variety of different clarifications and definitions of how operative sustainable communities may be achieved.

A capsule definition for sustainable development is a process which sets out to achieve progressive advancement for the human condition, which involves taking action and

attaining material growth and social fulfilment over time (Roseland, 2000). The general definition claims that sustainable development meets the needs of present generations without threatening the needs of the future (WCED, 1987). This definition expands understanding of the term sustainability, which originated from environmental considerations, into something encompassing social and economic aspects (Figure 4.1)

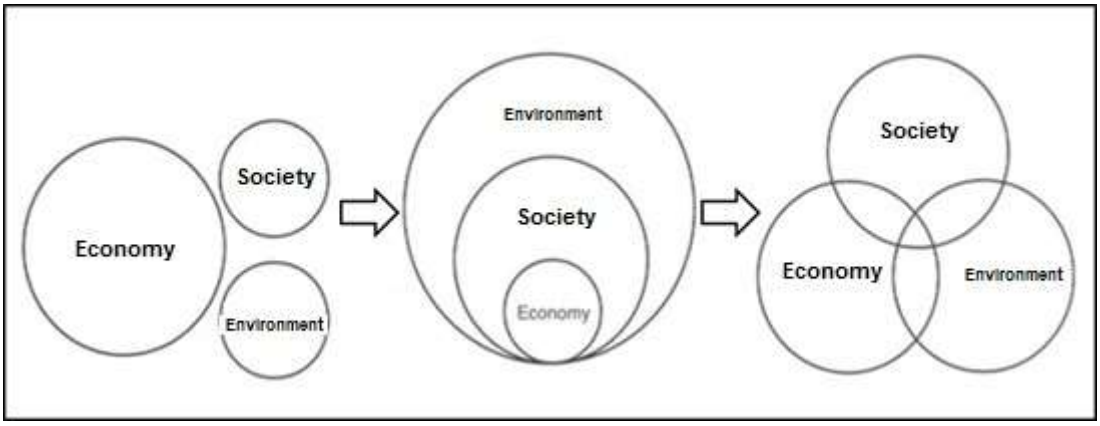


Figure 4.1: Sustainable Development Evolution (Friedman, 2007)

Rydin (2010) describes the fourfold aim of sustainable development as follows: the requirement to conserve natural resources, the balance between environmental loss and gain to achieve an unaffected total results, the need to reduce the ecological footprints to avoid damaging the world's natural ecosystems, the need to achieve social equity, and finally the need to avoid increasing additional risks for future generations (Figure 4.2).

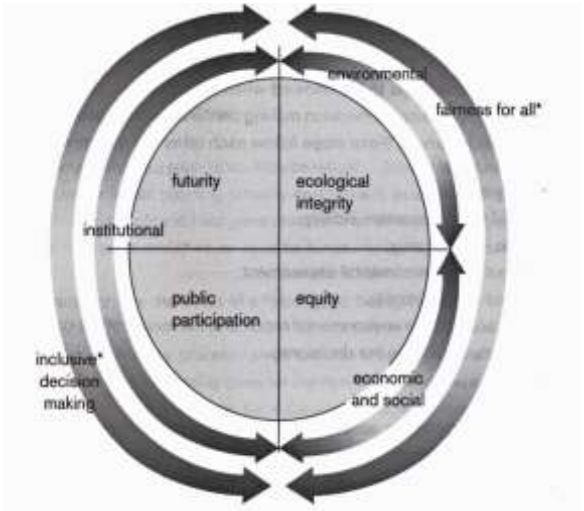


Figure 4.2: The Fourfold Definition of Sustainable Urban Form (Curwell et al., 2005)

Sustainable development is therefore about maintaining and enhancing the quality of life socially, economically, physically and environmentally while, in the meantime continues to preserve and support the natural supply and the eco-system resource (Naess, 2001& Barton, 2002). In this sense, cities need to be smart and intelligent to offer its citizens the quality living through adopting proper policies and programmes and selecting an appropriate sustainable urban development. Accordingly, in order to achieve state-of-the-art SUD, the main cores of the policy should be fulfilled and enhanced as follows:

4.2.1 Ecological Sustainability

Environmental protection has always been the major concern in sustainable development. In any particular development planners, architects and developers have to ensure that it has the minimum impact on the environment (Kim, 2010). Furthermore, Meadowcroft & Kenny (2002) suggest that environmental policy issues should be concerned with ensuring sustainable development. First, they argue that programmes must be developed to improve the efficiency of energy, to increase the quality of waste management, and to promote the facilitation of recycling materials (Figure 4.3). Secondly, they suggest that sustainable cities should consider the economic and social regeneration and environmental capacity of urban areas through involving reliable environmental governance which encourages green activities and climate change conventions. Recalling the other above-mentioned arguments, these objectives can be summarised as: the protection and improvement of natural resources; serious consideration for the built environment; efficient use of resources; facilitation of the high-density city; high resilience management; and comprehensive urban area management (CEC, 2004). Thus, sustainable development, by emphasising the global nature of environmental problems asserts that all nations/individuals, regardless of their geographical location, background and social structure, have a moral responsibility towards the preservation of the environment (Fouladi, 2006).

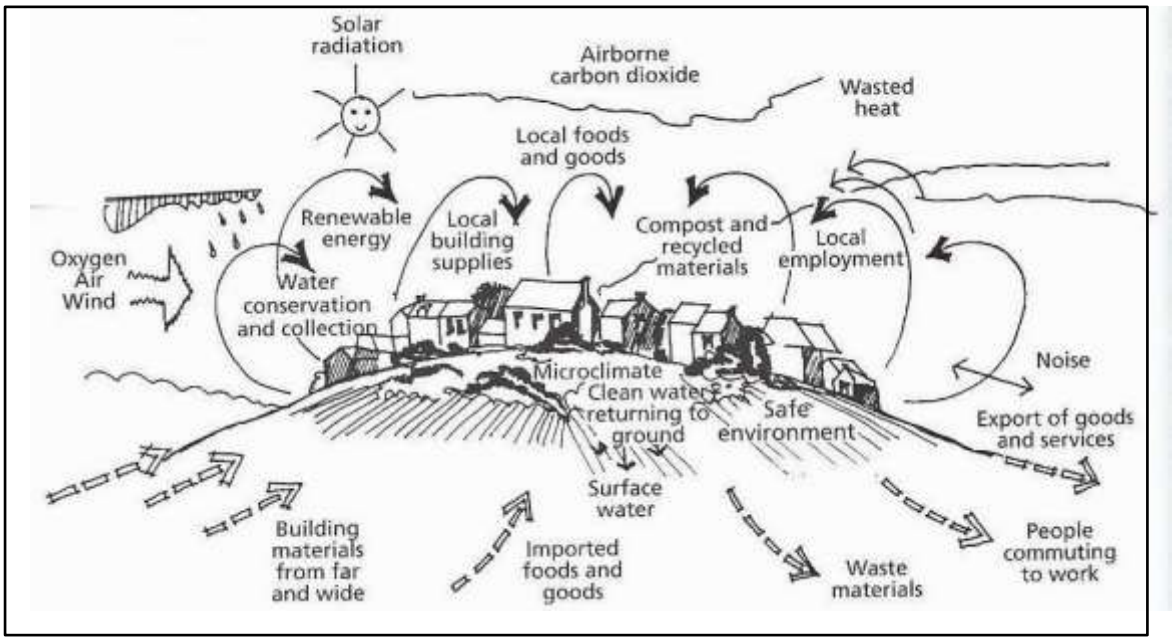


Figure 4.3: Ecological System of Small Settlements (Friedman, 2007)

4.2.2 Social Sustainability

This core is considered one of the most important principles included in the concept of sustainable development which involves society equity, cohesion, and quality of life. Moreover, it emphasises the fair sharing and preservation of resources and the consideration of the needs rather than the desires of the current and future generation. In the United Nations Habitat (1996, P12)), agenda 21 contained a significant interpretation towards a more sustainable form of society when it states '*Humanity stands at a defining moment in its history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being*'

The gap between the level of production and consumption of society cannot be filled only by relying on technological propositions or policy approaches; individual lifestyles and the values and behaviour of people need to be managed and controlled. Thus, Friedman (2007) suggests that sustainable development imposes a moral and ethical responsibility on individuals to reduce their excessive consumption and change it to sustainable

behaviour. Foster (2008) argues that social sustainability should be considered as subjective and qualitative, inclusive and democratic. This is because it is closely related to the attitude of people and how they respond to the change in their surrounding environment and provides a decent quality of life for communities. In addition, he suggests that sustainability addresses the question of how societies can shape their modes of change in order to ensure sustainable requirements for current and future generations.

4.2.3 Political Sustainability and Public Participation

Authority in the context of sustainable development comprises democratic and active participation of the public in the decision making processes. Roseland (2000) argues that governance contributes to improving communication and agreements between different stakeholders and construction companies about common issues and solutions. He describes further the significant role of the authorities in the planning process when he states that government does not only make decisions for communities but rather allows communities to be part of the planning process, taking into consideration all the values and interests of stakeholders.

Newman and Jennings (2008, P.157) indicate the role of community in the SUD when they state "*Sustainability rests on the ability of people to participate in decision-making processes and to contribute to the well-being of their communities. City governments need to develop strategies for empowering people through transformation of structures and processes which enable people to participate in decision making. This inclusion of a diversity of perspectives increases the resilience of societies, providing a wider range of solutions and responses to challenges and change*".

Curwell (2005) describes the importance of citizen's involvement in the planning process when he states that participation in decision making helps people to develop their consensus regarding the enormous issues of communities and enables them to provide the

sense of tenure toward the final outcome. Furthermore, it encourages individuals to take responsibility and create more equitable communities. Empowerment is important not just because it is a human right, but also citizen involvement often results in creative 'second-road thinking' that can lead to remarkable alternatives in SUD since the issues of sustainability sometimes require involving as many different views as possible in a creative strategic conversation (Walters, 2007).

4.2.4 Economic Sustainability

The demand for sustainable change in society has been a natural condition in many developing countries where political justice, achieved via the democratic process, is a prerequisite for economic equality. Thus, economic sustainability is defined as the ability of the economy of a nation to support the population and future generations having an adequate standard of living. Furthermore, the aim of any sustainable community is to institute local viable economies which are environmentally efficient and socially reliable.

There are many issues and problems related to a sustainable economy globally. Sun (2008) describes them through the unfair distribution of wealth between society classes. Elliott (2006) summarises these global issues in the developing countries when he clarifies that rapid demographic growth, unsupported levels of economic development, high income disparities, low urban budgets and lack of quality infrastructure, standard housing and basic services have a critical effect on achieving sufficient sustainable development and the value of policy instruments.

Sustainability is not merely about how to save the current planet, but to provide endurable continuous living for all species (UN, 1996). Therefore, economic vitality plays a significant role in ensuring that impact on the environment and social developments can be sustained. Stable and resilient economic growth would translate to better social prosperity and

improved environment management which would formulate a holistic equitable impact on urban sustainability

4.2.5 Physical Sustainability

Physical sustainability is the process of improving the built environment to meet people's requirements whilst avoiding unacceptable economic growth and social or environmental impact. One of the objectives of a sustainable built environment is to ensure that urban development is compatible with the natural environment and social principles so that the relationship between them is balanced and mutually enhanced. The definition by Allen (2001) seems to be the most comprehensive as it refers to the general aspects of development that includes physical, social, economic and environmental aspects controlled and supported by local authorities (Figure 4.4).

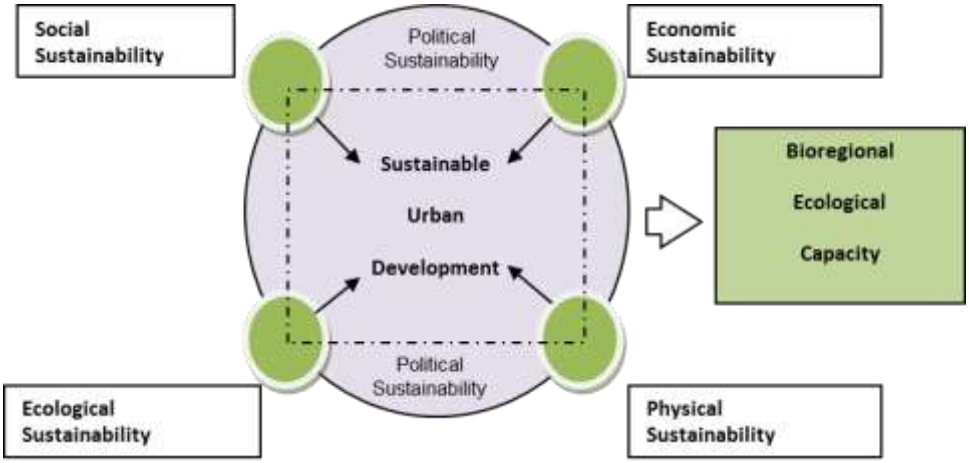


Figure 4.4: Holistic Image of Sustainable Urban Development (Allen, 2001)

Wheeler and Beatley (2008) indicate the prominence of sustainable planning approaches for sustainable urban development. They have emphasised that communities must be designed to regenerate and support the public realm, where neighbourhoods must be harmonised and human-scaled, districts must be diverse in use and population, and finally, the form and identity of the city must embrace historic contexts, respect unique ecologies, and integrate them into a comprehensive regional structure. Furthermore, Madanipour

(2003) describes the ideal layers of the built environment and the importance of their assimilation to achieve sustainable physical forms in the cities. He highlights that the physical built form of cities can be conceptualised as two interlocking planes. The first is the spatial structure of the city or the spatial distribution of activities and buildings. This covers the CBD, inner urban areas, suburb residential districts, and event satellite settlements and new towns. The second element is what are we might term the micro-environment, the pattern of streets, parks and the public realm. Sustainable integration between these layers lead to a compatible built environment.

4.3 Sustainable Urban Form

Sustainable urban form is currently a widely discussed topic in the concept of urban sustainability. The notion behind sustainable development policies within an urban context is that they should contribute to improving the overall sustainability of a city. Kim (2010) describe that city should be a settlement that has human welfare at its core. She adds that humans should be able to live in a friendly environment that is safe and healthy, where people have occupations, and where they can participate in local decision-making to identify their own needs and requirements within the community.

The United Nations of Sustainable Cities Programme (2001, P.1) defines a sustainable city as "*A city where achievements in social, economic, and physical development are made to last*". Jenk and Jones (2010) believe that a sustainable city has a long-lasting supply of the natural resources on which its development depends. Richard Rogers (1997, P.169) suggests that to achieve resilient sustainable cities, they must be planned to manage their use of resources. He states further "*we need to develop a new form of comprehensive holistic urban planning that will signal a new and dynamic equilibrium between society, cities and nature*". Rogers concludes his point of view by listing some of the many facets of the sustainable city:

- **A Just City**, where resources are fairly distributed and all people participate in government planning in their communities

- **A Creative Beautiful City**, where art and architecture stimulate the imagination to create better places and the potential of human resources are adapted to scope the future.

- **An Ecological City**, where ecological impact is decreased, and the built environments are well-protected and highly restored.

- **A Compact and Polycentric City**, where fringes are efficiently protected, and the neighbourhoods are integrated and encouraged to increase compactness.

- **A Connective Diverse City**, where the community, public realm and nature are strongly communicated and enormous activities are created to inspire and foster liveable and vibrant places (Figure 4.5).

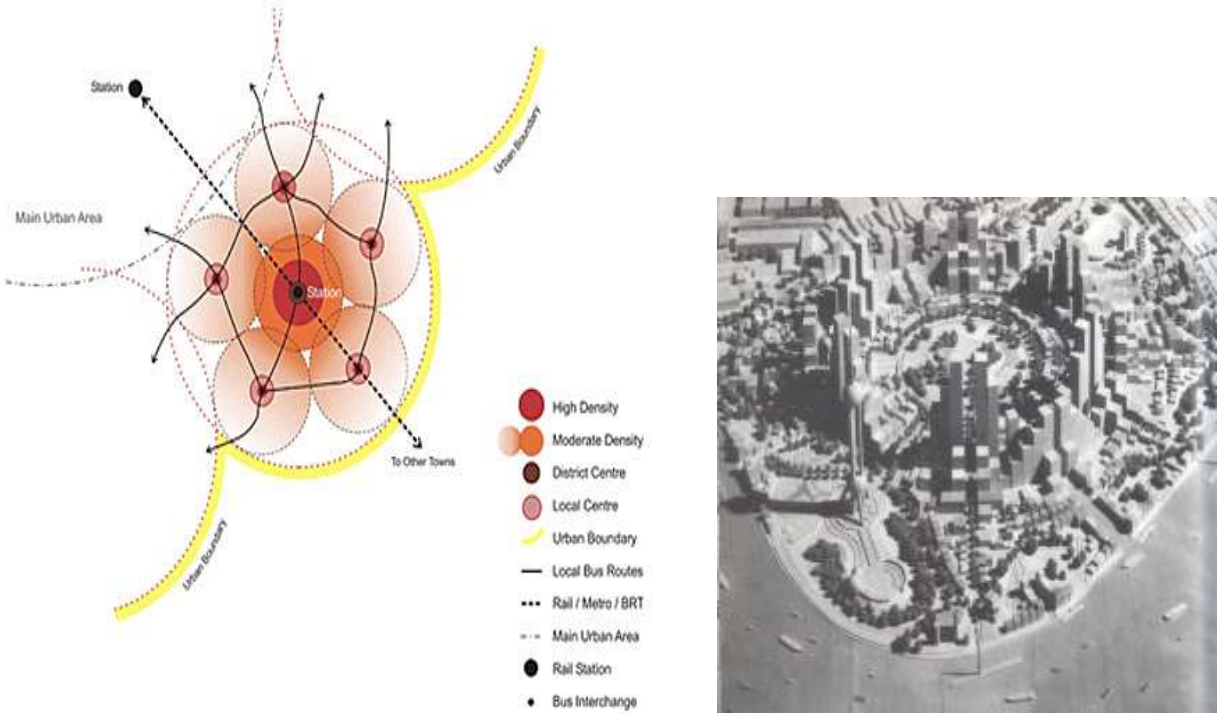


Figure 4.5: Roger's Vision of the Sustainable City (Rogers, 1997, P.48)

It would seem that a sustainable urban form could be defined as a form which depends on non-renewable resources, that is 'user-friendly' for residents and desirable as a place to live (Williams et al, 2000). Other scholars and researchers described the sustainable city and urban form as follows: sustainable cities are cities that ensure well-being and a good quality

of life for inhabitants who are treated equally, are environmentally friendly and socially integrated (Jenks and Dempsey, 2005). A sustainable city is a walkable and transit-served example of urbanism integrated with high-performance buildings and infrastructure. Haughton and Hunter (1994, p. 27) describe a sustainable urban form as "*the one which supports people and businesses as continuously endeavour to improve their natural, built and cultural environments at neighbourhood and regional levels, which always support the goal of global sustainable development*". Talen (2011) adds that sustainable urban form promotes walkability and connected streets, compact blocks, elegant public realms, diverse facilities and housing types which is divergent from the previous trends of city building that encouraged sprawling land use, socially and physically isolated dwellings, and car-dependent communities (Figure 4.6). Finally, Jabareen (2006) has identified seven pillars and concepts to achieve sustainable urban forms: compactness, sustainable transport, density, mixed land use, diversity, passive solar design, and greening.

Figure 4.6: Vancouver Compact Olympic Village, Canada (Moscovich et al., 2009, P.198)

4.4 Sustainable Urban Form Concepts

Regarding the physical sustainability of existing cities, literature describes a number of various approaches being considered and develops a variety of paradigms of sustainable urban form, which represent significantly different views of how these concepts are emerged and practiced globally. Furthermore, Short and Short (2013) have emphasised

that the search for the ultimate sustainable urban form may be better redirected to the search for a number of different approaches, models and forms which can respond to the variety of existing settlement patterns and contexts that have been identified through a holistic view of what sustainable societies of the past, present and future might be like.

In this sense, to recognise of the major impact of the urban form on extensive sustainable cities and neighbourhoods, a number of concepts and models related to sustainable urban forms have been identified worldwide. These concepts can be described as follows;

4.4.1 New Urbanism

The concept of new urbanism was developed by Andres Duany and Elizabeth Zyberk in the United States. It also initiated and built upon the ideas of several potent visions such as the garden city and modernist urbanism (Rani, 2012). New Urbanism is basically an urban design response to the anticipated concept of 'lack of authenticity'. Furthermore, it has been practiced to discourage suburban sprawl, proposed to encourage sustainable development and to facilitate infill expansion based on planning and architectural principles (Barton, 2002). It also focuses on providing a diverse range of job opportunities and pedestrian friendly neighbourhoods. The problem which new urbanism claims to avoid is ugly, sprawling developments which are car oriented. Other values that new urbanism has incorporated are amenities, equity of walkability, promoting increased density, strictly mixed communities, and creating efficiently homogenous enclaves (Walters, 2007). The CNU (2008) identifies the main characteristics and principles as follows;

- **Physical Form**: Compact, pedestrian friendly & mixed use, broad range of housing types and affordable prices to attract a diverse community.
- **Environment**: Green parks, community green spaces distributed to connect communities.
- **Transportation**: Encourages public transportation, reduce private vehicle usage, and promote connective corridors (roads, railway, rivers etc) as regional connectors.

- **Urban places**: create places that celebrate local history, ecology, and building practice.

One of the examples of the New Urbanism is Seaside in Florida, designed by Duany and Zyberk, where neo-traditional houses comply with a strict code and rules (Figure 4.7).

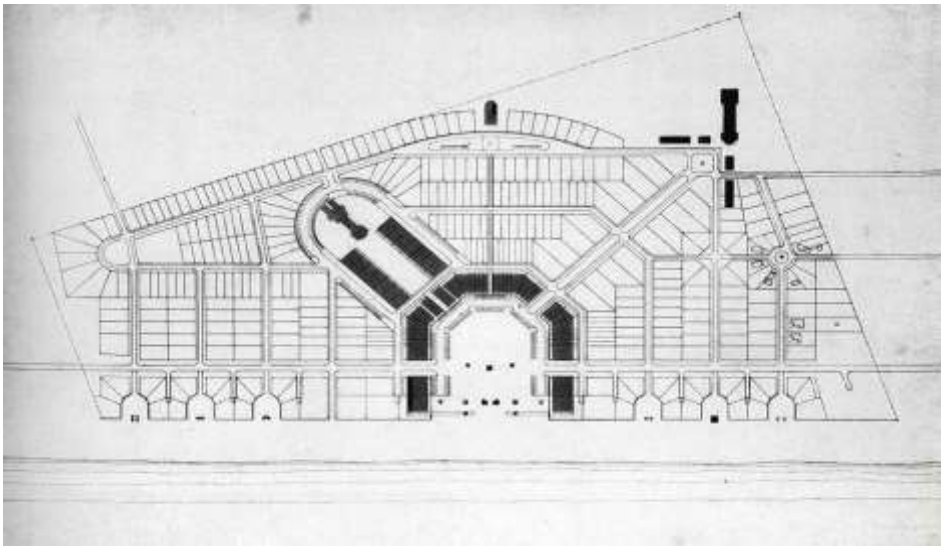


Figure 4.7: Seaside New Urbanism by Duany and Zyberk, Miami, USA (Carmona et al., 2003)

4.4.2 Smart Growth

The concept of smart growth was originated and initiated by the Environmental Protection Agency (EPA) in the United States, and it is equivalent to the sustainable communities in the United Kingdom. The smart growth agenda proposes reinvestment in existing landscapes to develop more efficient mixed-use communities as the main element of developing sustainable places (Mell, 2010). Generally the concept of smart growth is based on mass transit and on the environmental impacts of developments being limited. Many scholars believe that the sustainable urban form under the theory of smart growth refers to a city that encourages urban intensification and promotes public transportation. Farr (2009, p.28) states "*This movement provides the philosophical and practical bones of sustainable urbanism and advocates ten principles which are: mixed land uses, compact building design, variety of housing types, walkable neighbourhoods, preserve open space and natural resources, diverse transportation, and encourage community participation in development decisions".*

Smart growth is considered a multi-linear development and a set of cohesive urban and regional planning principles that can be mixed and formulated to unique local and regional settings to achieve better urban development. Smart growth and new urbanism are movements that continue to progress. However, despite its rapid increase in popularity and support, disagreement with the smart growth movement is led by individuals and organisations concerned with property rights, home construction, the car-production industry, and agriculture (Knaap and Talen, 2005).

4.4.3 Urban Containment

The characteristic features of urbanisation in the United States and many developed countries in the late twentieth century are their increasingly dispersed regional forms and socio-economic inequalities. Therefore, 'green issues' and urban containment policies have emerged as reactions to impose terrestrial constraints on urban growth and promoted many contrary strategies such as the conservation of energy and land, and pollution controls, and the thrust towards sustainable cities, along with the needs of social and spatial equity (Montgomery, 2007).

This approach is involved with the principle of limiting the outward expansion of urban development through urban containment strategies. Generally, there are three different strategies used by urban containment policies to shape metropolitan growth: greenbelts and urban growth borders are used to activate the "push" factors, while the urban areas are used to affect the "pull" factors (Jabareen, 2006). Consequently, central cities would not need to expand their boundaries outward but merely facilitate the current development after it has reached the containment boundary (Rodriguez, 2008). The primary objectives of urban containment are the efficient delivery of public facilities; the preservation of farms and forest land; the reduction of air, water and pollution, the cost of water, waste-water and

public utilities provision being kept low, and the cultivation of quality of life by creating a distinctly urban environment (Madanipour, 2003).

Critics against this policy suggest that this approach could result in raised real estate values caused by restricting potentially developable land limits which would eventually influence the low-income population. Moreover, this concept has encouraged developing high-rise high-density buildings everywhere rather than mixed-types or in selected locations particularly (Friedman, 2007).

4.4.4 Urban Villages

The sustainability agenda has forced the world into a reconsideration of how cities are built. The 'urban village' concept is based on a combination of urban design qualities from traditional towns and the neighbourhood idea to create a model of communities which are socially and economically mixed, and of high environmental quality (Cuthbert, 2011). Many scholars and much literature have attempted to describe and identify the characteristics of urban villages' policies. Panerai et al. (2004, P.134) states "*the Urban Villages Development should be characterised by a diverse architecture, legible layout, a variety of uses, sustained by an appropriate development, a choice of tenures, a strong sense of place, and a high level of involvement of local residents in planning and managing the development".* Newman and Kenworthy (1999) concentrate on the importance of creating walkable communities, traffic reduction, and state-of-the-art transit and bicycle planning as effective features in the development of urban villages. In addition to that, Towers (2005) identifies five essential qualities for an effective urban village as follows;

1- It should encourage pedestrian-friendly milieu and contain a wide range of activities.

2- There should diverse building types for residing in, and job-opportunities.

3- Occupations should be mixed both for residential development and employment uses.

4- It should provide an attractive high-density centre, and

5- high-quality built environment with a mixture of housing types and landscape.

In Canada, the urban (Olympic) village of Vancouver's Southeast False Creek is a 32-hectare former industrial brownfield site being redeveloped as a 'model' sustainable community (Figure 4.8). The City of Vancouver aims to create greater density throughout the city in a way that reduces the environmental impact, ensures the necessary physical and social equity and amenities, and supports new and different housing types as a way to promote affordability.

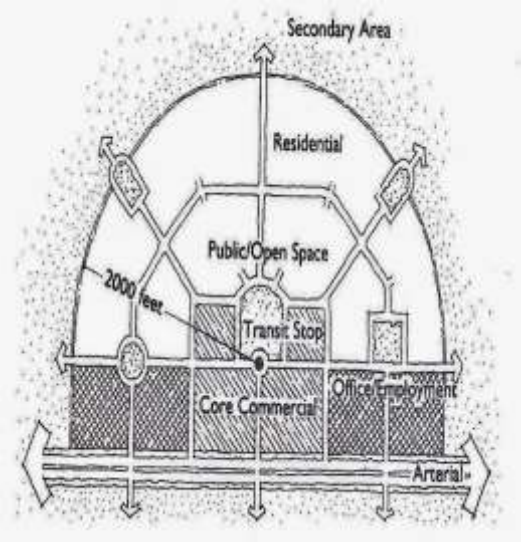
Figure 4.8: Olympic Village Map and Compact Residential Towers, Vancouver, Canada (Sussmann, 2005)

The development master plan has focused on creating a compatible and integrated community that promotes the principles of sustainable development in large-scale neighbourhood design (Moscovich et al., 2009).

4.4.5 The Transit City

The process of linking urban development with transit routes is recognised internationally as creating ‘transit-oriented developments’ (TODs), or ‘transit villages’ or ' Transit City' (Cervero, 1998). Calthorpe (1993) has configured a primary paradigm for creating attractive sustainable communities in the city and how they are connected to fringes (Figure 4.9) TODs have become more preferable and feasible among other approaches like ‘smart

growth' because of a growing citizen preference for inner-city living (Frey, 1999). Maat (2009, P.31) identifies the importance of this approach and argues "*among the strategies to reduce car travel, the idea of influencing land use seems plausible, as the spatial structure of housing, employment, services and leisure forms the context within which people travel*". In this sense, Newman and Kenworthy (1999) explain that TODs are an extension of this belief when they show land-use pattern modification can change the mode of travel by locating higher-density developments around transit stations (Figure 4.10).



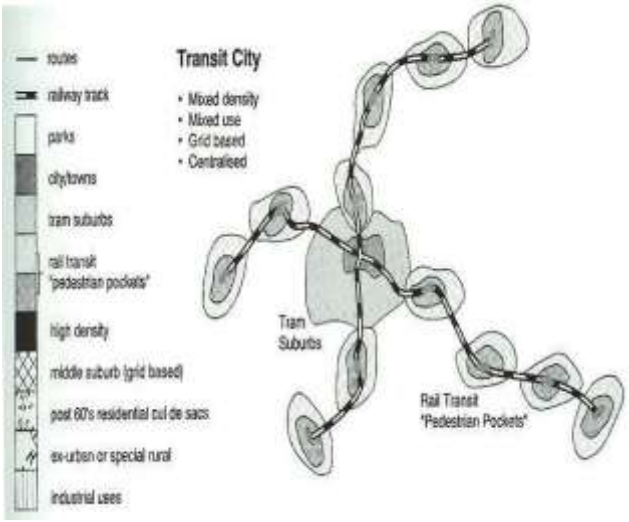


Figure 4.9: Primary Vision of TOD **Figure 4.10: Developed Vision of TOD (Newman and Kenworthy, 1999)**

Therefore when mixed-use development is combined with diverse passenger transport, the concept of a TOD leads to less vehicle dependence. Bernick and Cervero (1997, P.5) describe the concept as a high-density walking and transit node as they argue:

"*The transit village is a compact, mixed-use community, placed around the transit station. Transit villages also offer alternative living and working environments that combine the suburban values and lifestyle preferences for open space, human-scale buildings, and sense of security with the more traditionally urban values*".

A new extended-environmentally friendly version of TOD is the 'The Green TOD' which has been adapted in several European cities like Stockholm. Green TOD is a mixture of TOD and green urbanism. The combination can create compatible built environment beyond the sum of what TODs and green urbanism offer individually (Table 4.1).

Table 4.1: Characteristics of TOD and Green Urbanism (Cervero and Sullivan, 2010, P.6)

TOD Mobile Sources	**Green Urbanism** Stationary Sources
-**Transit Design** World-class transit (trunk & distribution) Station as hub - **Non-motorized access** (bike paths, pathways) - **Bike sharing/Car sharing** - **Minimal Parking** (reduced land consumption, building massing & impervious surfaces) - **Compact, Mixed Uses**	-**Energy self-sufficient** (renewably powered – solar, wind turbines) - **Zero-waste** (recycle); re-use; methane digesters; rainwater collection for irrigation -**Community gardens** (compost, canopies) - **Buildings:** Green Roofs, Orientation (optimal temperatures), Materials

Brownfield redevelopment in Hammarby of Stockholm is an excellent example of joining TOD and green urbanism which will be analysed in detail in chapter five (Figure 4.11). The public transportation system in the region, with car-sharing and bike-sharing, has eventually reduced private car dependency, pollution levels, and energy consumption. A hierarchy of roads are available to provide permeable and accessible destinations. The district can be easily reached from the nearby main roads. Cars on the main street are controlled to very low speed and all other streets are designed to same limitations (Towers, 2005).

Figure 4.11: Tramway and Compact Green Urbanisms, Hammarby, Stockholm (R. Ibrahim)

4.4.6 The Compact City

The compact city is a concept designed to implement sustainable development within the built environment and respond to the recognised negative social, economic and environmental impacts of urban sprawl. The concept of the compact city has been suggested by many scholars and literature as one of many methods of achieving sustainable urban forms. There have been many attempts to define exactly what a compact city is; Burton (2000) describes it as relatively high-density buildings, mixed-use facilities, based on an effective public transport system and indicators that promote walking and cycling-friendly communities. Furthermore, Jenks and Dempsey (2005, P.417) state "*future urban forms for city living will include: polycentric urban forms, closely linked to good public transportation systems, culturally appropriate increases in the density of development, that is responsive to the urban context*". The Urban Task Force (1999) identifies the compact city as an urban area of high concentric density around the main public nodes and corridors and gradually lower densities in the external and less accessible areas (Figure 4.12). The

main impact of this model is to establish an urban boundary to contain urban sprawl and decrease vehicle use while reducing considerably the need for longer journeys, which would be made by public transport. High densities are also associated with land development and energy-efficient buildings, and also with economies in the provision of urban infrastructure.

Williams (2000) provides a more comprehensive summary of the objectives for the 'compact city' approach, which are as follows:

- Improving the urban area, and increasing the quality of life in these urban regions.
- Enhancing social equity and providing services that are accessible to all residents.
- Improving the public transportation services and supporting cycling and walkability.
- Preserving the green areas and encouraging the efficient use of infrastructure.

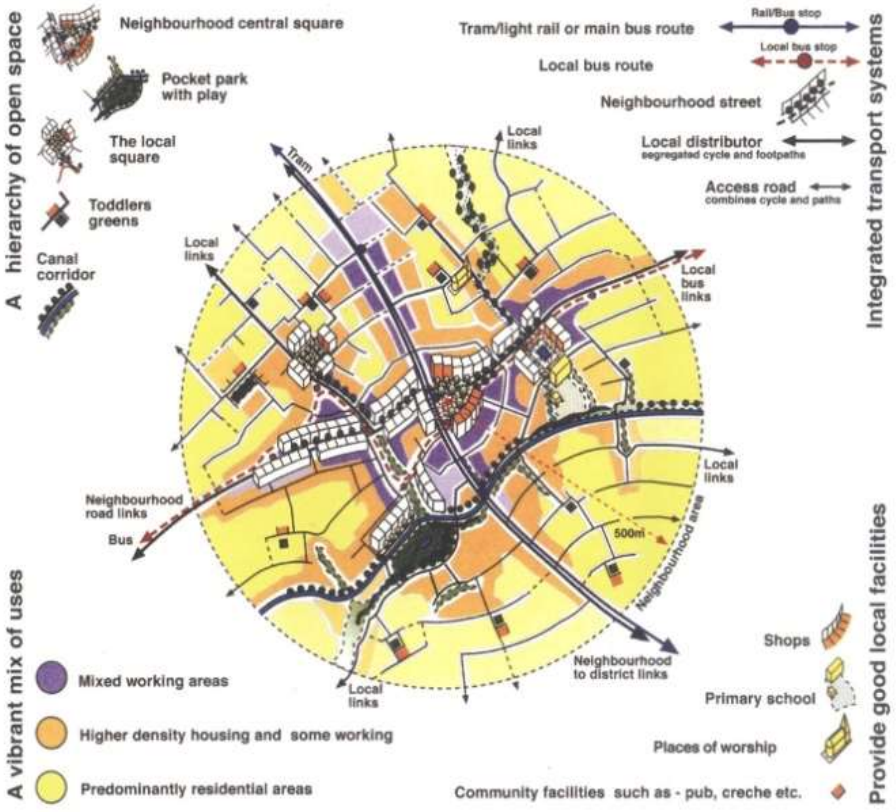


Figure 4.12: The Compact City Concept (The Urban Task Force, 1999, P.53)

Despite the benefits that a compact city can provide, development at higher densities may also result in unsustainable disadvantages and impacts like; reduction of vacant green

areas within cities, air pollution, traffic congestion, ,and lack of privacy characteristics (Jenks et al., 1996).

Curitiba, in Brazil, is considered as one of the most significant urban sustainability models in planning literature (Figure 4.13). The planning experience in the city is an emerging example of the compact-eco development approach, whereby principles of sustainability and citizen participation are guiding development policies within a rapidly expanding city of 1.5 million people in the developing world (Thomas, 2002). In 2010 the city was awarded the Globe sustainability award for its sustainable urban development. The city has been quite effective at integrating human and natural activities, and has avoided many of the overcrowding, pollution and lack of open space problems that have invaded other cities (Short and Short, 2013).

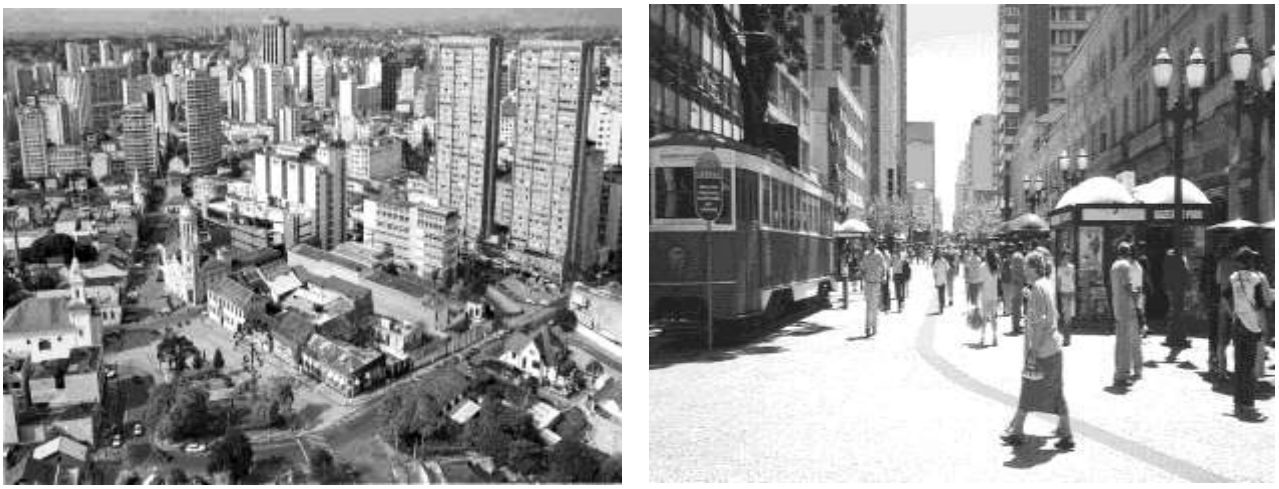


Figure 4.13: The New Compact Development and the Walkable Centre in Curitiba, Brazil (Suzuki et al., 2013)

4.4.7 The Walkable Communities

The walkable community provides an essential building-block in creating a sustainable urban form. Many scholars have interpreted that the walkable neighbourhood concept is necessary to increase sense of place and local identity, enhance socio-cultural cohesion, and improve populations' physical health. The design of walkable communities must

respect the needs of pedestrians, cyclists, and drivers equally (Moor and Rowland, 2008). Affordable and reliable public transportation that reaches across neighbourhoods and links them to city centres can release people from their dependence on vehicles. The locations of commercial and institutional buildings need to be placed within a comfortable 10 min walk which is equivalent to approx. 700-800 m. An efficient and safe network of pedestrian pathways will link the community services to the residential blocks (Friedman, 2007). To make walking more effective and safe, short blocks are designed to increase car intersections (Figure 4.14). Roads need to have multiple uses; they can provoke appropriate behaviour and increase sociability, interaction, belonging, and play zones (Talen, 2009).

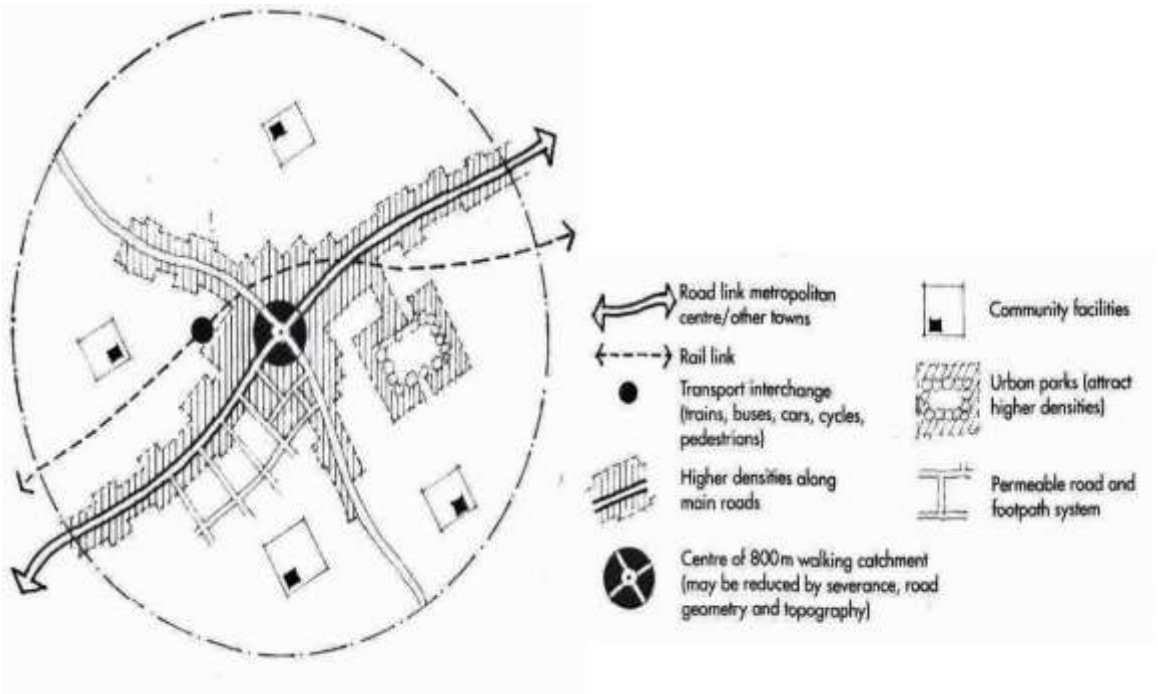


Figure 4.14: Walkable Community Attribute (Ritchie and Thomas, 2009, P.14)

Clarke et al. (2009) describes the main planning and urban design principles for this concept as follows:

- The neighbourhood provides a wide range of mixed and affordable community space.
- Housing densities are highest at the district centre and around the main road.

- Efficient transport routes connect the neighbouring centres and overlooking parks.
- A variety of services, shops and facilities are adjusted along the main streets and lead to the heart of the neighbourhood.
- Streets have multiple routes and functions and need to fulfil basic requirements like: pedestrian movement and furniture, temporary car parking, buses and tram stations, and cycling routes.
- New mixed -use developments are preferred at the fringes of the town/district centre and along the main movement routes.

Montpellier, in southern France, is a very distinctive sort of town. The city council decided in 1990 to turn most of the major streets into walking boulevards (Figure 4.15).

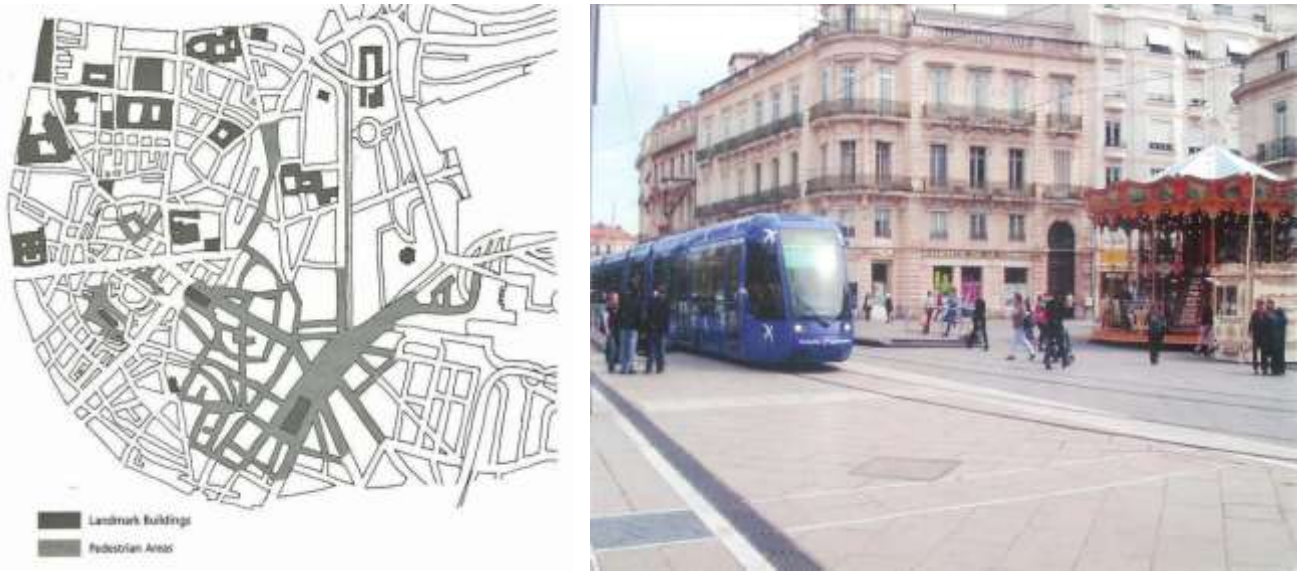


Figure 4.15: City Map and Walkable city Centre, Montpellier, France (Low et al., 2005, P.24)

Furthermore, all the streets around the huge place, centre of the city, de la Comedie, and the square itself are disabled to vehicle traffic except for a tramline that connects the pedestrian centre to the suburbs (Low et al., 2005). The mixture of trams and walkers seems to be entirely safe and workable.

4.4.8 The Eco-City

The rapidly increasing population and movements towards urbanisation in many regions today has required more sustainable forms of development. The impact of cities' components on the environment, society and economy has increased dramatically recently. The need for new trends has emerged and several models are established and used, all concerned with the relationship between cities and the environment, such as 'green city' (in the UK and China), 'garden city' and 'eco-town' (in the UK), 'ecological city' (in the USA), 'healthy city' (in Europe) (Sun, 2008). During the early 1900s, eco-city projects were motivated towards the design of urban land use patterns, but more recently most projects have given more eminence to reducing the environmental impact, energy efficiency, preservation, and waste management (Barton, 2002).

The eco-city concept is concerned with the relationship of the built environment, society, climate, and the economy should be principally from an ecological (environmental) perspective. New cities are often designed by urban planners who attempt to integrate all of the latest "green" technologies in order to create the most sustainable built environment. Roseland (2000) provides a richer conception that the eco-city concept evokes several related paradigms and movements such as healthy communities, appropriate technology, community economic development, social ecology, the green movement, bioregionalism, and sustainable development. Eco city defines the development of sustainable human communities within harmonious and balanced built environments. It is rapidly becoming a quality concept, essential to any urban planning with a serious concern about social and environmental problems (Ruano, 2008).

Freiburg in south-west Germany has developed a reputation as Germany's 'ecological capital', focusing on transport, environmental protection and energy saving (Low et al., 2005). The most significant development occurred when the old town centre became car-

free very early in 1973 (Figure 4.16). Moreover, the government-led development of the new district of Vauban incorporated an incentive to residents whereby they would save on housing costs if they signed a contract stating they would live without a car (Friedman, 2007). The reason why Freiburg is called an ecological city rather than a sustainable city is because it integrates the environment into land-use planning rather than compromising with it. The city really embraces nature and seeks to operate within environmental limits. The wider urban strategy is based around a framework of existing public transportation nodes (trams and buses), lined by mixed-use buildings which are inter-linked by a series of landscaped public spaces and pedestrian and cycle routes interconnected in a compact city centre (Short and Short, 2013). The sustainable characteristics of this city will be discussed in detail in the next chapter.

Figure 4.16: Pedestrian Oriented Centre in Vauban, Freiburg, Germany (Moor and Rowland, 2008)

4.4.9 Smart and intelligent Cities

Recently, during the latest years, the world population has preferred living in urban districts increasing the burden on the built environment. Improving the urban quality of life is the main sustainable strategy required to provide the appropriate living standards for citizens in these cities. Therefore, the utilisation of technology has been one of the essential tools

which has supported this policy and played a major role in providing smart solutions to overcome many related problems (Dameri, 2013).

Many scholars and scientists have attempted to define smart and digital cities. Su et al. (2011) claims that the ideal smart city is the Trinity City which means either a smart sustainable city, an intelligent eco city, or intelligent eco cyber city, integrating the physical built environment and technological resources, natural assets and knowledge properties, human resources and creative investment (Figure 4.17). Briggs describes the 'intelligent city' as not a new concept, and city intelligence as a notion that is interrelated to the traditional city form, which is derived from its built context, cultural trends and habits, and available technology (Briggs et al., 2005).

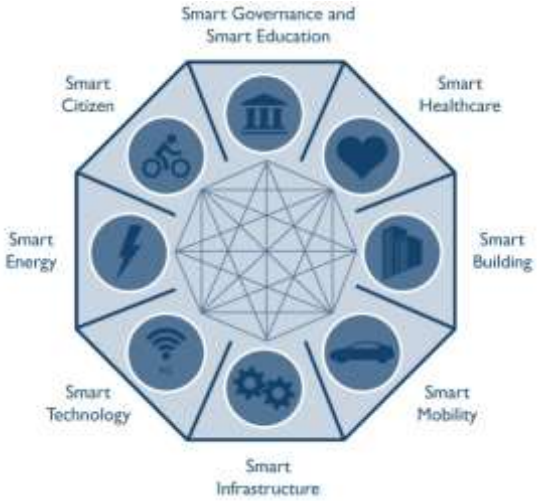


Figure 4.17: Smart City Concepts (Frost and Sullivan, 2013)

In addition, Isheda (2002, P.77) states that "*The concept of Digital City is to build an arena in which people in regional communities can interact and share knowledge, experiences, and mutual interests".*

Komninos (2013) addresses the prototype of the sustainable community through claiming that the smart city is a unified urban concept with four interrelated layers, all planned, developed and managed as its integral parts:

-A digitally smart and intelligent city using digital urban spaces, modern entrepreneurship, creativity, intelligent city management platform, and quality virtual lifestyles.

-Sustainable, ecological buildings, a healthy and eco-friendly environment.

- A master-planned knowledge ecosystem and innovative business environment, fostering a climate and culture of innovation.

- A smart integration of living and residential, working, commercial, recreating, learning, and public spaces, buildings and facilities.

Masdar City (Figure 4. 18), meaning ‘the source’ in Arabic is a smart, carbon neutral and zero-waste city presently being built in the desert near Abu Dhabi in the United Arab Emirates to host 50,000 residents and 40,000 commuters (Manghnani and Bajaj, 2014). One of the essential visions and aims of the city plan is to place Abu Dhabi as a global hub for the research and development of green, renewable energy and sustainable technology building efficiency, energy networks, sustainable transport, and low-carbon energy production (Masdar City, 2009).

Figure 4.18: Site Work of Masdar City, Abu Dhabi-UAE (Wagle, 2014)

4.5 Summary

To conclude, reviews of previous research and literature have revealed that there is a strong relationship between urban form and sustainable urban development. The various concepts of urban form seem to have similar objectives, which are to address sustainability issues through five elements: environmental protection, social equity, economic viability, integrated institutions and physical compaction.

The chapter has presents holistically the various concepts and approaches of sustainable urban forms. This chapter is a complementary part with chapter 2 and 3 to develop a comprehensive theoretical framework regarding the spatial patterns of urban form and its essential role in achieving sustainable urban forms (the first objective of this research).

In this sense, regardless of the specific concept or approach used to develop or regenerate the city, there are several main features which related to urban pattern and need to be considered in order to achieve a sustainable urban form. These common key principles are: an appropriate access to facilities, multi-modal transportation, physical and visual connection of buildings and districts, compatible built environment, diverse residential blocks and mixed land use, well-designed open spaces, equity and social cohesion, preservation of urban identity and heritage locations, and the involvement of society in planning and the design process. Understanding these key principles is crucial as a foundation to developing a holistic concept and the key elements that would impact on the overall urban sustainability.

The next chapter 5 a comprehensive practical framework of indicators is formulated and explored in many sustainable residential districts. The main aim is to address the important role of practical framework in achieving sustainable urban forms in the developed countries.

Chapter 5: Indicators of Sustainable Urban Form

5.1 Introduction

This chapter explores the most significant factors and indicators (as derived from previous related studies), that are considered the main criteria for assessing and achieving sustainable urban forms in cities in general and to evaluate the current existing urban pattern of Erbil city in particular. These indicators are supported by worldwide examples, formula for calculations and the analysis of selected global experiences and sustainable residential projects. The main aim is to identify how these dimensions have been practiced and evaluated globally in order to formulate a holistic practical framework of these sustainable indicators which will be adopted in the empirical part of the study.

5.2 Urban Pattern and Sustainable Urban Form Indicators

Defining and measuring sustainable urban forms which is sometimes termed `sustainable urban neighbourhoods', 'sustainable urbanism' or 'sustainable community', has significantly progressed over the past two decades (Jenks and Dempsey, 2005). Many scholars have demonstrated the importance of these indicators and dimensions and how they may play a major role in the process of evaluating cities and communities deemed to be the most sustainable. Crilly (2000) argues that built environment measurement would provide a comparable basis for numerous and disparate indicators. Using spatial patterns representation of indicators of sustainable urban forms is a means of assessing the nature of the urban structure and layout ensuring direct implication to issues of quality of life, physical design and urban form. Newman and Jennings (2008) state the advantages and the challenges of urban patterns indicators and the positive impact of these dimensions in the context of sustainability, when the contradictions between two factors or more appear in the same context.

The urban patterns indicators is a practical evaluation framework which has been formulated according to the various approaches of urban patterns in chapter 3 and depending on the key findings that has been derived from the numerous sustainable urban forms conceptions in chapter 4. This conceptual model provides a comprehensive understanding of how sustainable urban forms can be evaluated in the context of a built environment by setting the indicators' definitions, potentials, key dimensions and the linkages between indicators into a synthetic structure. Accordingly, there are more than one variable relating to the indicators which has been considered and mentioned as a significant part by scholars and literature. These variables comprise the holistic conception of each indicator and will be considered in the assessment check-list of the local context in chapter 8. However, Jenks and Jones (2010, P.4) have identified some issues and problems regarding sustainable urban forms indicators. They state that "*there are indicators which are related to social and physical sustainability which are difficult to measure and quantify unlike the environmental and economic aspects like equity, privacy and identity*". Therefore, it will be obvious that many indicators and variables will be assessed subjectively depending on its applicability in the local context.

Many researchers and much literature have identified eight significant indicators that related to the spatial patterns of urban form and used to measure and evaluate the built environment in the context of sustainability. These indicators are categorised as the followings: Accessibility, Connectivity, Compatibility, Diversity, Containment, Density, Urban Identity and Adaptability.

5.2.1 Accessibility

People prefer to live adjacent to their work places and fulfil the majority of their daily needs at the closest facilities. Accessibility briefly means the ease of access between activities which are located in specific places. The precise relationship between the arrangement of

urban forms and people's activities constitutes an essential characteristic in achieving sustainable urban forms. Jenks and Dempsey (2005) define accessibility as reaching a range of activity locations within an acceptable time, particularly from the home and the workplace. They further add that the most important considerations of accessibility are the quality of building arrangements, the quality of the urban transport system, and the urban land-use structure (Figure 5.1).

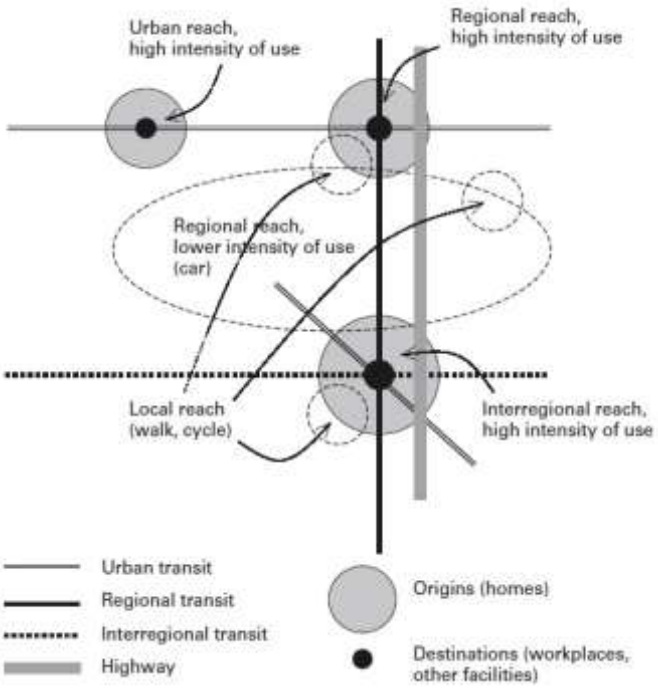


Figure 5.1: Multi-Modal Accessibility in Urban Regions (Jenks and Dempsey, 2005, P.84)

Accessibility is considered an essential indicator for achieving sustainable cities. Many scholars have noticeably described the relationship between accessibility and sustainable urban forms. Newman and Kenworthy (1996) indicate the meaning of accessibility as urban efficiency, equity and sustainability as well as the extent to which people have the means to access places, services and facilities outside their local area. Burton and Mitchell argue that a sustainable city pattern should increase access between residents, their places of work and the services they require (Burton and Mitchell, 2006). While Jabareen (2006) states that the compact city strategy has been strongly encouraged in the pursuit of sustainable

urban forms, and is dependent on good local accessibility to the numerous buildings and to resident's services. Related to this, sustainable urban form is defined by the degree to which it supports a friendly and car-free built environment. Therefore, many other scholars have connected high accessibility with reducing the dependence on vehicles. Masnavi (2011) describes a sustainable city as a settlement which has good and equal accessibility to the amenities and services of the city. When locating local facilities within walkable distances from the home, the need to own and use private cars is decreased and other transport costs are diminished.

Recently, measures of access have been used extensively as part of an effort to evaluate the built environment for health effects. Talen (2011) argues that walkable access to services is an essential part of the sustainability equation because people living in well-serviced locations will tend to have lower carbon emissions. Therefore, accessibility in walking distance to local services and facilities should include public transport nodes/stops with distances between them of 400-800m. Song and Knaap (2004) have offered a practical equation to calculate accessibility when they suggest using the median distance to the nearest activity (daily use): is the shorter the distance, which is consider the greater the accessibility. The main reasons for these different calculations are to improve the local access to local facilities and district access to the city centre (Scheel, 2011).

5.2.2 Connectivity

The organisation of urban form and building pattern has an exclusive interrelationship with the movement network system. Therefore, the emerging focus on designing sustainable urban forms and the arrangement of buildings reflects the diversity of contemporary requirements for highly connected and permeable built environments. Hence, urban connectivity refers to how urban blocks and spaces are connected within the district and with adjacent neighbourhoods visually and physically (figure 5.2). Talen (2011) defines

connectivity as the degree to which the built environment offers points of connection and contact to people and properties at a different scale. This quality encourages the concept of sustainability through increasing the level of interaction between residents and community which is believed to improve neighbourhood consistency in the long term.

Figure 5.2: High Pedestrian Permeability in Birmingham, UK (R. Ibrahim)

Urban form plays a significant role in promoting or constraining connectivity. Arrangement of urban pattern parameters such as connectivity, space permeability, and local neighbourhood integration is considered an essential indicator in achieving sustainable communities (Moughton, 2003). Carmona adds as an urban form vision, increasing connectivity translates to smaller block perimeter, more street intersections, fewer dead-end streets and cul-de-sacs, creation of central places where multiple activities and facilities are provided that promote a liveable and sustainable neighbourhood (Carmona et al, 2003). Continuity and permeability of the built environment is a greatly acceptable approach through which more sustainable urban forms may be achieved. Proximity also refers to urban contiguity and connectivity, which suggests that future urban development, should take place adjacent to existing urban structures (Wheeler and Beatley, 2008). Finally, Durmaz (2012) states that connectivity and permeability are central to enhancing the sense

of vibrancy and liveability, as they properly provide the movement and social interaction of communities, so they are essential criteria of a sustainable built environment. Thus, most scholars and literature have asserted the vital role of continuous neighbourhoods in achieving sustainable urban forms which present a contrary vision to the “gated communities” concept. Socially, gated communities tend to separate districts and residents from the neighbouring area, which soon leads to a sense of segregation and inequality. However, security, reduced traffic, and high property value are the most important advantages provided by gated communities. Friedman (2007) argues that convenient connections need to be provided between and within urban areas particularly between larger communities, commercial facilities and places of work. Routes within the area should be permeable for everyone and as direct as possible, and for this reason “gated estates” should be discouraged.

Song and Knaap (2004) have developed four measures of connectivity which involve the number of nodes and intersections, the distance between points of access into the neighbourhood, the number and lengths of blocks, and the lengths of cul-de-sacs;

-Internal Connectivity: number of street intersections divided by the sum of the number of intersections and the number of cul-de-sacs; the higher the ratio, the greater the internal connectivity.

-Blocks Perimeter: median perimeter of blocks; the smaller the perimeter, the greater the internal connectivity.

-Blocks: number of blocks divided by number of housing units; the fewer the blocks the greater the internal connectivity.

-Cul-De-Sac Length: median length of cul-de-sacs; the shorter the cul-de-sacs, the greater the internal connectivity.

5.2.3 Compatibility

Urban compatibility refers to the capability of urban form to be homogenous and harmonic with the surrounding buildings and open spaces. Scheel also defines compatibility as maintaining harmony, balance, and unity of forms and patterns of buildings (Scheel, 2011). Rogers (1997) describes the importance of this indicator in the sustainable arrangements of urban buildings. He argues that to create a sustainable community, the urban environment must be compatible and the spatial development should be improved and integrated. Furthermore Kriken (2010, P.134) indicates the significant role of urban compatibility in the sustainable design of cities when he states "*City design should be practiced on a variety of related scales with different purposes in mind. In planning practice, achieving design compatibility is a prior request in the concept of sustainable context. It seeks to establish a range of visual tolerances that do not disrupt the character of a particular place*". Therefore, the planning and arranging of building masses as part of an urban network emphasising not only reformation of the existing fabric, but also the development of new, compatible structures, which can create cohesive cities and promote urban sustainability (Figure 5.3).

Figure 5.3: Harmony in Residential Buildings, Olympic Village, Canada (City of Vancouver, 2009)

Beatley (2007) addresses the substantial relationship between the concept of urban form compatibility and the notion of sustainability. He argues that sustainability has been widely applied in urban development nowadays to achieve sustainable urban forms. Concepts like: accessibility and continuity of spaces, ease of movement, and promoting a compatible urban environment are allowing people to be connected to the proper functioning of the urban network. In addition to that, Talen (2011) describes the good and compatible urban fabric or residential district performance according to many interrelated characteristics: first, its ability to provide the basic requirements to its residents e.g. biological and social needs; second, its diversity in types and services; and finally, its imageability.

Many scholars and much literature have interpreted the notion of urban compatibility, features, and requirements for obtaining good cities or sustainable urban forms. Lynch (1984) summarises these requirements in five aspects. They are called performance dimensions and can be identified as the following: **vitality** (liveability), **sense** (identity), **fit** (congruence), **accessibility** (openness), and **control** (stability). These qualities are about the appearance and compatibility of places. Neuman (2005) adds more aspects to enhance the physical appearance of the built environment. Features like: **visual appropriateness**, **harmony** and **richness** can be interpreted easily by many people and create satisfying sensory experiences. Finally, Scheel (2011) adds even more characteristics to enrich the urban compatibility. He describes elements like; sense of **human scale**, **legibility** and, as well as **imageability** of the built form of the neighbourhood, improved access, perception and comprehension of the built form, which would eventually establish a better quality of life.

Accordingly, an assessment framework of compatible urban pattern can be formulated to evaluate the urban patterns of neighbourhoods and decide whether they contribute and promote the notion of sustainable urban forms (Figure 5.4).

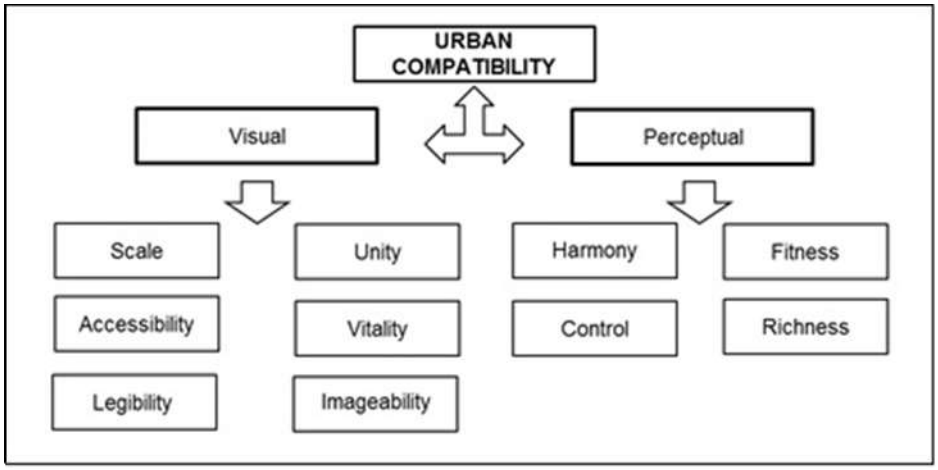


Figure 5.4: Urban Pattern Compatibility Assessment Framework (R. Ibrahim)

5.2.4 Diversity

Undoubtedly, diversity is considered one of the significant indicators in achieving sustainable cities. Community stability is enhanced if the neighbourhood consists of a variety of house types, daily services and facilities, and a mix of tenures (Figure 5.5). This is addressed by Jabareen (2006, P.42) when he states *"diversity represents the social and cultural context of the urban form*". Large cities in developed and developing countries are characterised by numerous diverse and intense connections and activities; where people live, work, shop and play. This provides high levels of vitality and vibrancy and attains the needs of economic and social reproduction (Barton et al., 2010).

Figure 5.5: City Centre Diversity in Riga, Latvia (R. Ibrahim)

Most scholars and planners have intensively identified the role of urban diversity in creating sustainable communities. Sassi (2006) describes the ideal neighbourhood as the one which has efficient public transport; a well-defined human scale; diverse shops and facilities; and high quality of life. Giddings is convinced that successful sustainable cities should provide a diversity of housing, all with good quality surroundings, including homes for families, and affordable properties to rent and buy (Giddings et al., 2005). Moughton (2003) suggests that sustainable urban pattern approaches have focused recently on providing and encouraging the main attractions of city living, services or mixed-use facilities adjacent to citizens residence, horizontally in the same street or vertically in the same building (Figure 5.6). Finally, Talen (2011) considers diversity an important dimension of sustainable urban form which promotes many sustainable concepts like; social interaction, liveable districts, walkability, permeability, and economic vitality. She explains that the diverse housing-types and the balance of land-uses is an essential strategy to achieve sustainable communities, where socially mixed neighbourhoods and social equity is highly considered.

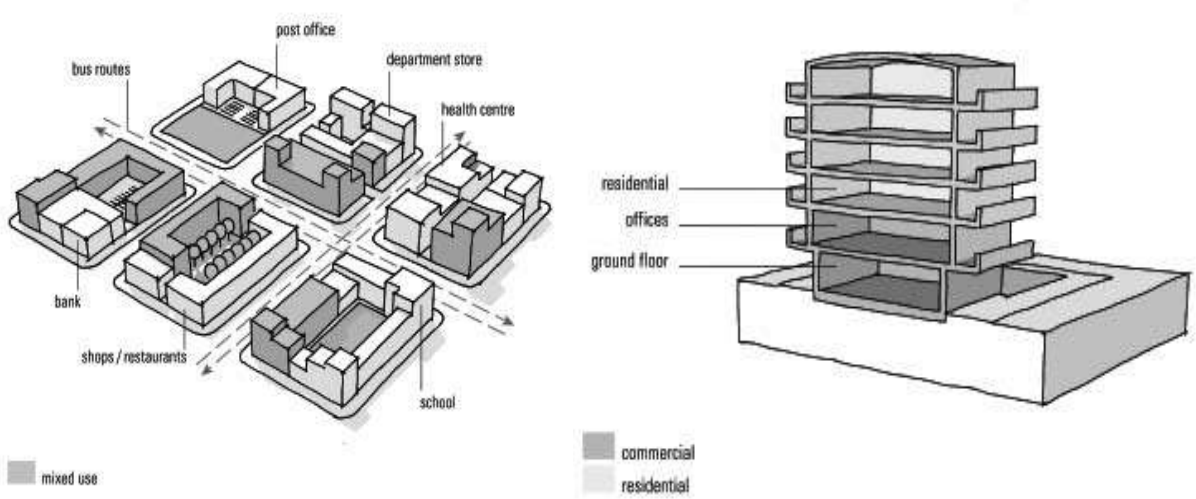


Figure 5.6: Mixed-Use Facilities within Residential Types (Kriken et al., 2010, P.90)

Scholars attempt to measure diversity and mixed-use services depending on many factors like: type, provision, location of facilities, and the area of the district. Burton et al. (2000)

identifies the diversity indicator of urban districts as mix-of-use. This indicator can be measured according to three aspects: number and ratio of the facilities provided, horizontal mix of land uses and vertical mix of uses. Song and Knaap (2004) believe that greater mixing of uses facilitates lowers vehicle use, which improves the environment and enhances urban sustainability. They offer two measures of land use mix:

-**Mix Actual**—acres of commercial, industrial, and public land uses in the neighbourhood divided by the number of housing units; the higher the ratio, the greater the land use mix.

-**Mix Zoned**—acres of land zoned for central commercial, general commercial, divided by the number of housing units; the higher the ratio, the greater the mix.

5.2.5 Nodality and Containment

The creation of accessible, social, and liveable nodes and open spaces is one of the significant dimensions in achieving sustainable urban forms. The articulation of buildings and the surrounding spaces creates valuable nodes which should be strongly considered in the planning and design process. At a neighbourhood level, Frey (1999) believes that sustainable urban form is interrelated with mono-centric or poly-centric models of urbanism where urban growth and building organisation are created around sustainable nodes (Figure 5.7). In this sense, a neighbourhood node may-be both large enough to comprise enormous mixed-use facilities that serve the district, and small enough to be reached easily and safely. In addition to that, Watson et al. (2003, P.2.9-5) considers urban cores an important sustainable urban aspect when he states "*Nodes are the strategic foci into which the observer can enter, typically either junctions of paths, or concentrations of some characteristic. But although conceptually they are small points in the city image, they may in reality be large squares".*

Finally, Talen (2011) indicates the important role of neighbourhood open spaces and nodes in achieving sustainable communities. She describes the nodes and the containment of blocks as a small paradigm of “community” where residents share various activities and communicate. This would substantially promote the sustainable built environment concept.

Figure 5.7: Sustainable Residential Node in Stockholm-Sweden (R. Ibrahim)

Planners and architects, when measuring urban nodes and urban spaces, are in need of an appropriate perception of the principles, and the factors affecting these spaces in order to establish an authentic connection between the people, spaces and the buildings. Porta et al. (2008) suggests that the degree of centrality is the simplest definition of node centrality. It is based on the idea that important nodes have the largest number of ties to other nodes in the district. Furthermore, Bramley et al. (2011) identifies significant dimensions of successful and sustainable residential nodes. He explains that residential schemes and configurations depend extensively on residential nodes and open spaces and if they provide: privacy and good sound insulation; connectivity, distinctiveness and integration with the surrounding area; proximity, safety (surveillance) and high accessibility to local services, facilities, and public transport; human scale and proportion; and adequate landscape, signs, outdoor furniture, and art sculptures.

5.2.6 Density

Density is another essential component and an important characteristic in definitions of sustainable urban form. There is a common agreement among scholars that high density and compactness of buildings lead to more sustainable cities (Burton, 2002; Jenks et al, 1996). Many scholars indicate the role and importance of compactness, density, mass proximity, intensification, and contiguity in the latest sustainable urban strategy. Jabareen (2006) considers intensification which 'uses urban land more efficiently by increasing the density', which is a major strategy for compactness and contiguity of the built environment as essential approaches for achieving sustainable communities. Sassi (2006, P. 205) adds that proximity of buildings reduces the amount of energy used and the cost of infrastructure. She states that "*District heating, for instance, becomes viable above densities of 40 dwellings per hectare. Other services such as recycling and community composting are also more economically viable at higher development densities*". Kriken et al. (2010) indicates that the degree of coherence of spatial patterns of buildings can be defined by the solid-void relationship in an urban space. When the balance changes towards proximity of the masses, buildings and structures, within a certain area the degree of contiguity of urban fabric increases relatively. Consequently, this increase enhances the compact character of the space.

Figure 5.8: Urban Compactness in the Developing Countries, Cairo, Egypt (Dave, 2008, P.47)

Finally, Pont and Haup (2009) address the importance of spatial coherence between urban spaces and the arrangement of contiguous buildings to achieve an urban balance in the sense of sustainable urban design. They explain further that the differences between a fragmented space structure and contiguity also keep the perimeters within the limits.

Urban density has been identified by Santamouris (2006) as an urban-form indicator in addition to the social and environmental impacts during the last few decades. Tower (2005) suggests that density is a measure of the number of people living on an area of land which can be a small or large area. He also adds that on a smaller scale, density may measure the population of a neighbourhood or an individual estate or development. A scholar like Dempsey et al. (2012) describes density measures in another way. He indicates that residential density may be described as the number of dwellings, bed spaces or habitable rooms per hectare, acre or square kilometre; while building density may be described via plot area, floor area ratio or ratio of open to built-up space. Furthermore, Song and Knaap (2004) offer three measures of single-family development density: SFDU lot size, density, and floor space.

-**Lot Size**—median lot size of SFDUs in the neighbourhood: the smaller the lot size, the higher the density.

-**SFDU Density**—single-family dwelling units divided by the residential area of the neighbourhood: the higher the ratio, the higher the density.

-**Floor Space**—median floor space of SFDUs in the neighbourhood: the smaller the floor space, the higher the density

Porta et al. (2008) considers the Multiple Centrality Assessment (MCA) an important tool that measures different types of centrality, contiguity of buildings, and outputs the results graphically. Finally, Jenks and Jones (2010) add that MCA provides an objective way of systematically measuring elements such as street networks, the type of layout and the level

of compactness, and complexity of the layout. One of the significant measurements that MCA fulfils is the Closeness Centrality which measures to which extent a mass is near to all the other masses along the urban block.

5.2.7 Identity

The perception of the built fabric has the value and meaning of different objects and physical relationships that people experience in their daily engagement with the city (Tomlinson, 2003). Kevin Lynch (1960) asserted that the identity of a place can be observed and roughly measured by simple tests of recognition, recall and description. The sustainable city is one that basically lasts through the ages, which has the ability to restore it-self. Therefore, one of the crucial definitions of sustainability is the equitable preservation of the built and natural environments, cultural heritages, and economic opportunities and encouragement to generate and protect the sense of place and identity of the city (Farr, 2008). Hence, creating distinctiveness and preserving a unique and memorable sense of a place and making changes to the urban fabric that complement or enhance the character and human appeal of a place is considered an important dimension for a good sustainable city (Newman and Jennings, 2008). Moreover, integrating historical features and traditional characteristics in modern planning has proven effective in maintaining the distinctive character of sustainable cities, more specifically in places which have a rich history (Kriken et al., 2010).

Urban identity in the sustainable cities focuses on the significant values of the local urban character that will inspire the contribution of local citizens in urban activities. These Urban characters emphasises the built environment in order to stimulate human behaviour to increase the sense of belonging to that place (Misni and Aziz, 2015). Therefore, they must take advantage of identifiable, unusual, and special features to help create a unique and memorable city (Durmaz, 2012). Urban identity was measured in previous research by

identifying the amount of meaning attached to a place. Scholars and researchers identified different factors, elements and indicators to measure the urban identity of a place. A holistic framework of the essential urban identity criteria can be organised as in table 5.1.

Table 5.1: Sustainable Indicators to Measure Urban Identity (R. Ibrahim)

Components	Criteria	Elements
Physical Features	Functionality	Land use
		Mass & Void
		Skyline
		Topography
	Urban Form	Layout & Pattern
		Location
		Access
Dynamic Activities	Vitality	Street activity
		Liveability
	Diversity	Intercation
		Access and Permeability
	Accessibility	Containment
Meanings &	Distinctivness	Image
Symbols		Visual Access
		Distinction
	Socio- Cultral	Durability
		Traditional &
		Historical

Talen (2008, P.152) emphasises the significant role of urban identity as a distinct aspect in achieving sustainable urban form. She states that "*Looking at urban identity as key to successful strategies for making places for sustainable development the creation of some sort of identity for a diverse space is important, possibly crucial. It serves to hold a diverse population together and provides a way of binding disparate people and places*". In this sense, urban identity cannot be judged exclusively on the coherence and modernity of its physical characteristics, but also on how it articulates holistic components of socio-cultural, historical, environmental, behavioural and political elements. Urban planning and design, as

a part of sustainable development strategy has strong commitment to creating places which acquire a unique meaning and sense of identity in order to accomplish an ideal sustainable urban context. These could appear in sophisticated and centuries-old quarters of the city more than in modern plans with their social engineering approaches

5.2.8 Adaptability and Futurity

Urban form plays a significant role in promoting or facilitating integrity and positive change. This principle can be applied universally, recognising the need to vary it by local climate, culture, geography, and history. For many communities, surviving in a polluted world along with social, economic and political issues will be an enormous challenge. Giddings et al. (2005) asserts that the quest for adaptable population, management and urban strategies is one of the ultimate demands of sustainable cities. Many scholars indicate the significant role of adaptability, futurity and resilience as crucial factors in achieving long-lasting cities. Elkin et al. (1991) lists four underlying principles of sustainable urban development: environment, equity, participation, and adaptability. Newman and Jennings (2008, P.92) confirm the essential roles of adaptability and resilience in achieving sustainable cities by stating "*Cities can become more sustainable by modelling urban processes on ecological principles of form and function, by which natural ecosystems operate. The characteristics of ecosystems include diversity, adaptiveness, interconnectedness, resilience, regenerative capacity, and symbiosis".* Briggs et al. (2005) suggests that adaptability is a key to the smart and sustainable city and emphasises the need for dimensions to measure, manage and control urban transformation and change to ensure the city's long-term sustainability.

Accordingly, many scholars have attempted to define urban futurity and resilience depending on their research areas. Bristow (2010) defines urban resilience as the ability of city systems to resist, absorb and tolerate alteration in a well-timed and efficient manner before adjusting around a new set of structures and processes. This means basically the

preservation and restoration of the city's essential basic structures and functions. In addition to that, Redman (2014) asserts the role of adaptability as an important indicator in the context of sustainable cities when he defines it as the capacity of an urban system to be robust and experience pressure and impacts and to be adaptable and retainable of functions, feedback capabilities and its identity. Finally, Salat et al. (2014) adds that resilient cities in the context of sustainability should be able to develop plans, policies and strategies for future development and growth taking into consideration the physical, environmental, social, economic and political impacts that the urban systems are likely to accommodate. Therefore, any evaluation of how sustainable urban communities are over time will need to look at the adaptability of both physical and social systems. This is essential to understanding how urban areas work and to avoid inflexible approaches to design.

A central question that is relevant both theoretically and for practical reasons is the question of how resiliency is measured in an urban setting. Newman and Beatley (2009) suggest that it is more correct to call a region "resilient" when it responds positively to challenges and to enormous impacts in ways that maintain its functional system and even increase good outcomes. The theory would then suggest that this particular region had adopted, intentionally or not, features of a resilient region. Kahan et al. (2009) identifies a list of factors which are useful in assessing community resiliency or adaptability as follows:

-**Population size**: resiliency ratings vary directly with population size:

-**Location**: locations of important routes and services; orientation and spatial integration.

-**Management and Maintenance**: the physical condition during and after completion.

-**Functionality**: the suitability and flexibility of the building

-**Amenities**: combines both civic amenities as well as natural amenities.

-**Robustness**: robustness is the flexibility to use a place for a variety of purposes.

The key to sustainable futures of urban/building patterns lies in generating built environments capable of adapting to any urban changes. It is very important to create relevant models of building arrangements, and urban patterns which will eventually be flexible, renewable, adaptable and capable of transformation and self-redefinition in relation to context changes.

5.3 Global Case Studies

This section reviews the initial identification of two existing potential residential case studies. Each example is selected to cover a broad variation of urban form within a specified sustainable development. Together they comprise a field-based laboratory for testing and comparing proposed sustainable urban form measures and indicators of residential neighbourhood form and pattern.

5.3.1 Hammarby City in Stockholm, Sweden

Hammarby Sjöstad, in Stockholm is one of the most ambitious sustainable development projects in the world. The city of Stockholm has described the area as one of the world's highest profile examples of sustainable city development. Hammarby Sjöstad is visited by over 10,000 decision makers and specialists in the field every year, making it one of Stockholm's most important destinations (GlashusEtt, 2012). The green inner-city district is built to the south of Stockholm in1995 on land formerly and currently is used by the port. Stockholm City Planning Bureau has worked on the master plan to occupy an area of about 200 hectares (Figure 5.9), which, according to the master plan, will comprise 11,000 apartments, for about 25,000 residents, and an additional 200,000 m^2 area of commercial space by the year 2018 (City of Stockholm, 2006). The main concept is the conversion of an old industrial and harbour area (brownfield site) into a modern, sustainable neighbourhood (Faller et al., 2010). According to literature and site observation by the

researcher, an assessment of the district has been achieved depending on the performance of the sustainable urban form indicators as follows:

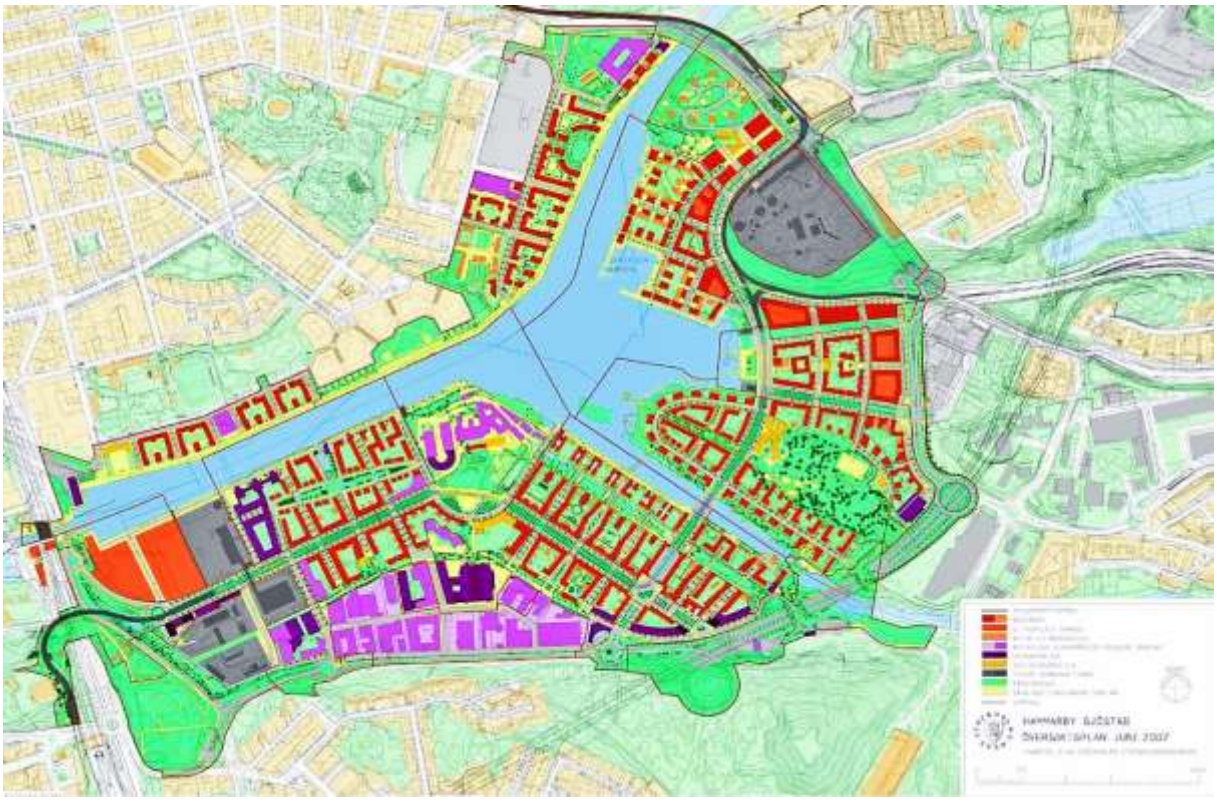


Figure 5.9: Master-Plan of Hammarby District, Stockholm, Sweden (City of Stockholm, 2006)

Accessibility

Hammarby Sjostad has a diverse system of transportation to serve its residents. The light rail link (Tvarbanan) infrastructure, bio-gas buses, and a ferry-link system, that takes five minutes to cross the lake of Hammarby (Towers, 2005). The district is accessible from all directions to provide high connectivity and reduce traffic congestion. There has also been an emphasis on reducing the use of private vehicles and encouraging walkability and cycling through the provision of safe networks of pedestrian and cycle lanes. Limiting car accessibility and having diverse means of transportation are attractive options which would enhance sustainable environmental, social and economic development (Iverot and Brandt, 2011). Daily needs, facilities and public transportation stations are accessible within max 10 min. of walking which promotes walking and decreases the use of private vehicles.

Connectivity

The main spine of this new district is a 37.5m (120ft) wide boulevard and transport corridor, which connects key transport nodes and public focal points, creating a natural focus for activity and commerce (Haas, 2012). In this district, the cycle and walk paths are much appreciated, especially along the lake (Figure 5.10). This provides small parts of Hammarby quarter with a vivid and liveable touch. These public spaces, however, lack resting areas and interactive places. The connectivity, proximity and visual permeability among the blocks are highly valued. However, linkage with other neighbourhoods needs substantially more identified and cohesive corridors (Cervero and Sullivan, 2010).

Compatibility

This residential neighbourhood has an inner-city character with new, exciting architecture, establishing classic urban qualities in a modern shape. Inner-city street dimensions block lengths, building heights, and densities are well harmonised, proportionate and offer openness, sunlight, parks, and water views. The mass-void relation, contiguity and legibility are thoroughly studied and designed (Towers, 2005). Although the project has been designed by various architectural offices, the general theme, unity and architectural rhythm of the building have been arranged with spectacular harmony (Figure 5.11).

Diversity

Hammarby Sjostad has a vibrant urban centre that is contiguous with and integrated into the inner city and the city core due to its extension of the typical Stockholm character (Towers, 2005). The area has diverse building floors (apartments over 4-8 floors).The ground floors of nearly all the buildings along the main corridor have been designed as flexible spaces, suitable for retail, leisure or community use. To enable retail use, these buildings have high floor to ceiling heights (City of Stockholm, 2006). The neighbourhood offers different retail and job opportunities. Several banks, real estate companies and

advertising agencies have settled in the area. There are, however, no health centres, pharmacies and competitively priced grocery shops available (Maciukenaite, 2013).

Nodality and Containment

A network of varied parks, green spaces and walkways runs through the district to provide a counterbalance to the dense urban landscape. Most apartments with balconies provide a view of the streets, waterfront walkways and open spaces (Walters, 2007). The open spaces and activity nodes evolve along movement patterns with intimate enclosures by the urban blocks and visual interaction between residents and visitors. Human scale and building proportion are well-defined and respected. However, the closer to the main street, the more the district loses its green image, and seems comparable to a usual city centre (Faller, 2010).

Density

The decision and the main idea of this project was to transform the area around the Hammarby Lake in correspondence with the ideas from the compact city concept (City of Stockholm, 2006).The area was converted into a concentrated residential area with compact buildings with five storeys on average, but with reasonably spacious green courtyards. This residential district has been planned with a dense settlement structure of 115 apartments per hectare and 270 persons per hectare which is compatible with many residential quarters in the city centre (Maciukenaite, 2013).

Identity

The traditional city structure of Stockholm has been adopted and combined with a new architectural style that responds to its specific waterside context, promotes the best of contemporary sustainability technology and follows modern architectural principles of maximising light, and views of the water and green spaces (Faller, 2010). The designers had set out to create a very characteristic and specific identity. In Hammarby, this related

very directly to the scale and grain of the city centre of Stockholm, re-interpreted in a modern style (figure 5.12). In addition to that, it is obvious that in order to enhance urban identity and sense of belonging in an area, distinctive spaces and nodes, pieces of arts, and architectural details have to be offered to cause the attachment to the place (Svane et al., 2011).

Adaptability and Futurity

This project lacked participation of the users in planning processes and the interaction between inhabitants and their willingness to change behaviour towards environmental responsibility and conservation (Stockholm City, 2006). The location, orientation, and district management are important futurity urban planning tools that are already well-identified in Hammarby Sjöstad. The flexibility of using open spaces and the robustness of the project are high appreciated (Svane et al., 2011). The GlashusEtt as the social centre of the area made good experiences through interacting with inhabitants (Iverot and Brandt, 2011).

The aspiration of the master-plan team to create a new 'inner city' district has been carried through effectively, with high density development creating an urban district that can sustain a range of shops and services. The urban planning and building arrangement for the neighbourhood has ensured diversity in architecture, a fine grain, texture and human scale. In particular, the way in which the master plan area has been divided into sub-areas, as linear and clustered pattern organisation to ensure the highest intimacy and containment. Each of these sub-areas was the subject of a cooperative design process ensuring that a variety of different architects were involved, but all working within the context of the master plan and its design codes has helped to ensure both unity at a strategic level, harmony of building collaboration and variety of details. Stockholm didn’t get the Olympics of 2004 (Athens won), but they have acquired an amazing urban district that Swedes can be proud

of for decades to come. The assessment of sustainable urban form of this district has been carried out depending on many references and the field survey (Table 5.2). The results confirm that this quarter is a remarkably successful new urban neighbourhood, combining a high quality public realm, compactness and homogenous arrangements of urban pattern.

Figure 5.10: Arial View, Hammarby (City of Stockholm, 2006)

Figure 5.11: Unity and Hamony of Hammarby (R. Ibrahim)

Figure 5.12: Urban Enclosure and Visual Integration with Open Spaces in Hammarby (GlashusEtt, 2012)

Table 5.2: Sustainable Urban Form Assessment of Hammarby Residential District. (Ivrot & Brandt, 2011; Svane et al., 2011; Faller, 2010; Maciukenaite, 2013).

Indicators				**Scale**		
		V. Good	Good	Moderate	Weak	Unavailable
Accessibility	Access to					
	Local Services		x			
	Public Transportation	x				
	Public Spaces		x			
	Buildings	x				
Connectivity						
	Internal Connectivity		x			
	Blocks Perimeter		x			
	Blocks		x			
	Col-de-Sac	x				
	with other Districts			x		
Compatibility						
	Unity		x			
	Scale	x				
	Orientation		x			
	Fittness and Harmony	x				
	Legibility		x			
Diversity						
	Mix of Uses			x		
	Vitality			x		
	Vibrancy			x		
Containment						
	Privacy		x			
	Safety and Security	x				
	Scale and Proportion	x				
	Design and Landscape	x				
	Accessibility		x			
Density						
	Building Density	x				
	Population Density		x			
	Contiguity	x				
Identity						
	Physical Features		x			
	Dynamic Activities			x		
	Meaning and Symbols			x		
Adaptability						
	Location	x				
	Robustness		x			
	Amenities		x			
	Management			x		
	Public Participation					x
Total Score		11	14	7	0	1

5.3.2 Eco-Residential District in Vauban, Freiburg, Germany

Freiburg is known as the 'Green City', hosting 408 hectares of parks, green areas and playgrounds with its new green settlements/eco-suburbs of Vauban and Rieselfeld. The Vauban Quarter was created (1998-2010) on an area of 41ha located 3 km to the south of the city centre (Figure 5.13), on terrain where social and ecological concepts were integrated through the planning and development of what used to be the site of a military base (Freiburg City Council, 2008). Right from the beginning all issues (mobility, energy, housing, social aspects etc.) were discussed in working groups which were open to residents (Broaddus, 2010). Many scholars have studied and analysed the district since it represents a distinguished example of sustainable urban development. Moor and Rowland (2008, P.45) state;

"*It is an attractive, family-friendly neighbourhood for 5,100 people, in which civic commitment, collective building and living with ecological awareness has great importance. Planning group has taken into consideration, creates flexible urban design which allows for current development and provides the possibility to adapt future planning*".

Figure 5.13: Vauban Master-Plan, Freiburg, Germany (Freiburg City Council, 2008)

Accessibility

It was planned from the beginning that most of Vauban's vehicles should be restricted to reaching most of housing units (Cervero and Sullivan, 2010). A hierarchy of roads are available to provide permeable and accessible destinations. The district can be easily reached from the nearby main roads. Cars on the main street are controlled to 30 k/h and all other streets are designed for very low-speed travel. Both the city centre and rail station are accessible in about 12 minutes by bicycle, with comfortable and well-protected sidewalk cycle lane provision (Broaddus, 2010).

Connectivity

Permeability and connectivity are highly encouraged through efficient planning of the pathway network (Ruano, 2008). Coherence is provided through the extensive use of ecological measures and the 'car-free' and 'parking-free' concepts of living. Direct access to close districts is identified and encouraged (Friedman, 2007). Visual and physical connectivity are utilised through creating safety corridors among the blocks (Figure 5.14). The current compact proximity serves well-proportioned spaces and enclosures (Broaddus, 2010).

Compatibility

The general style is simple and relaxed modernism with a majority of rendered walls and balconies, with some timber and metalwork used to enrich the facades (PRP Architect, 2008). Massing and architectural treatment is moderately simple and restrained, often enlivened with colour and with planting draping over balconies (Figure 5.15). This neighbourhood comprises places that display visual appropriateness and richness and contain buildings that seem adequate for the local urban context (Low et al., 2005).

Diversity

Freiburg's aim of becoming a 'City of Short Distances' is partly achieved through avoiding of traffic contact, which is accomplished through mixed land-use patterns and near-ubiquitous public transit (Cervero and Sullivan, 2010). Friedman (2007, P.133) says: "*The mix land uses which not only bring destinations closer but also creates an active, vibrant street life and instilling a sense of safety and security*". The inter-mixing of housing, shops, restaurants, workplaces, social centre, and other activities places many destinations close together, thus inviting more walking and bicycling not only to access rail stops but also for neighbourhood shopping and socialising (Broaddus, 2010).

Nodality and Containment

The articulation of buildings and the arrangement of the urban pattern are relatively simple and create proportionate open spaces. The spaces between the buildings are as important as the buildings themselves and have been designed with great care and attention to detail (PRP Architect, 2008). Several large green spaces separate the residential blocks, providing recreation and social interaction areas (Figure 5.16). Additional greenery and walking trails adjoin the stream forming the southern boundary of the site, providing yet another draw for families and minimising the need to travel out of the district in search of pleasant recreation areas (Low et al., 2005).

Density

Vauban's density supports a diverse compact array of neighbourhood businesses, transit infrastructure and community gatherings and hence offers a better quality of life than existing suburbs (Freiburg City Council, 2008). It has been planned with a dense settlement structure of diverse building types, with a net density of approximately 95 units per hectare and 122 persons per hectare (Cervero and Sullivan, 2010). Buildings are mostly simple in

terms of their form and construction, relying on the compactness and contiguity codes of compact cities.

Identity

Urban identity in Vauban has no specific local uniqueness, history or landmarks. However, eleven blocks of the former barracks were preserved and renovated to keep the identity and characteristics of the old district. Moreover, many unique places like cafes and small shops were provided to enhance the sense of place. Equal attention has been paid to the district's social and cultural life as well as to technical aspects, marketing, and urban building (Moor and Rowland, 2008). The district lacks specific features that reflect the local identity of the Freiburg region.

Adaptability and Futurity

Freiburg has been leading the way in Europe and is showing both how to build new communities that are truly sustainable, and how to involve communities in the process (Freiburg City Council, 2008). In Vauban, residents were closely engaged in the development process at every level and continue to be involved in running the district which ensures they are still closely engaged in the development process at every level (Friedman, 2007). In this district, the development process is strongly led by city planners, and there are high standards in place for future building (Broaddus, 2010).

The development plan for Vauban has included some regulations for the design and layout of the homes. These included the prohibition of detached houses, thus leading to a compact urban building structure and the prohibition of buildings exceeding four storeys. The pattern of buildings has emphasised a linear –grid arrangement to achieve variety and distinctiveness and this has been encouraged through the preferential allocation of land to private builders and co-operative building projects. This is illustrated by the numerous individually designed façades, which create a special atmosphere. A diversity of building

shapes has been created through the division of land into small plots, and legibility is provided through the master planning of the district and the creation of a distinct market place and neighbourhood centre. The massing of the scheme is well considered and creates both varied external spaces and a differentiated skyline. The strong and thoughtful design ensures that its mixed uses and internal layout are clear. Throughout, the scheme's external and internal finishes are drawn from a simple, limited palette of colour, texture and materials, including wood. The assessment of the sustainable urban form of Vauban neighbourhood has been carried out depending on various studies and the field survey (Table 5.3). The evaluation reveals the quality and efficiency of the built environment in Vauban neighbourhood in the context of sustainability. The comparison of the indicators reveals significant variations in both districts (Figure 5.17).

Figure 5.14: Vauban District Arial View

Figure 5.15: Social Interaction in Vauban (Freiburg City Council, 2008)

Figure 5.16: Compatibility in the Residential Façade, Vauban, Freiburg (PRP Architects, 2008)

Table 5.3: Sustainable Urban Form Assessment of Vauban Residential District (Friedman, 2007; PRP Architect 2008; Moor, 2008; Cervero & Sullivan, 2010).

Indicators				**Scale**		
		V. Good	Good	Moderate	weak	Unavailable
Accessibility	Access to					
	Local Services	x				
	Public Transportation	x				
	Public Spaces	x				
	Buildings		x			
Connectivity						
	Internal Connectivity	x				
	Blocks Perimeter		x			
	Blocks		x			
	Col-de-Sac		x			
	with other Districts		x			
Compatibility						
	Unity	x				
	Scale	x				
	Orientation		x			
	Fittness and Harmony		x			
	Legibility		x			
Diversity						
	Mix of Uses		x			
	Vitality		x			
	Vibrancy		x			
Containment						
	Privacy	x				
	Safety and Security	x				
	Scale and Proportion		x			
	Design and Landscape		x			
	Accessibility		x			
Density						
	Building Density		x			
	Population Density			x		
	Contiguity			x		
Identity						
	Physical Features			x		
	Dynamic Activities			x		
	Meaning and Symbols				x	
Adaptability						
	Location		x			
	Robustness		x			
	Amenities			x		
	Management		x			
	Public Participation	x				
Total Score		9	18	5	1	0

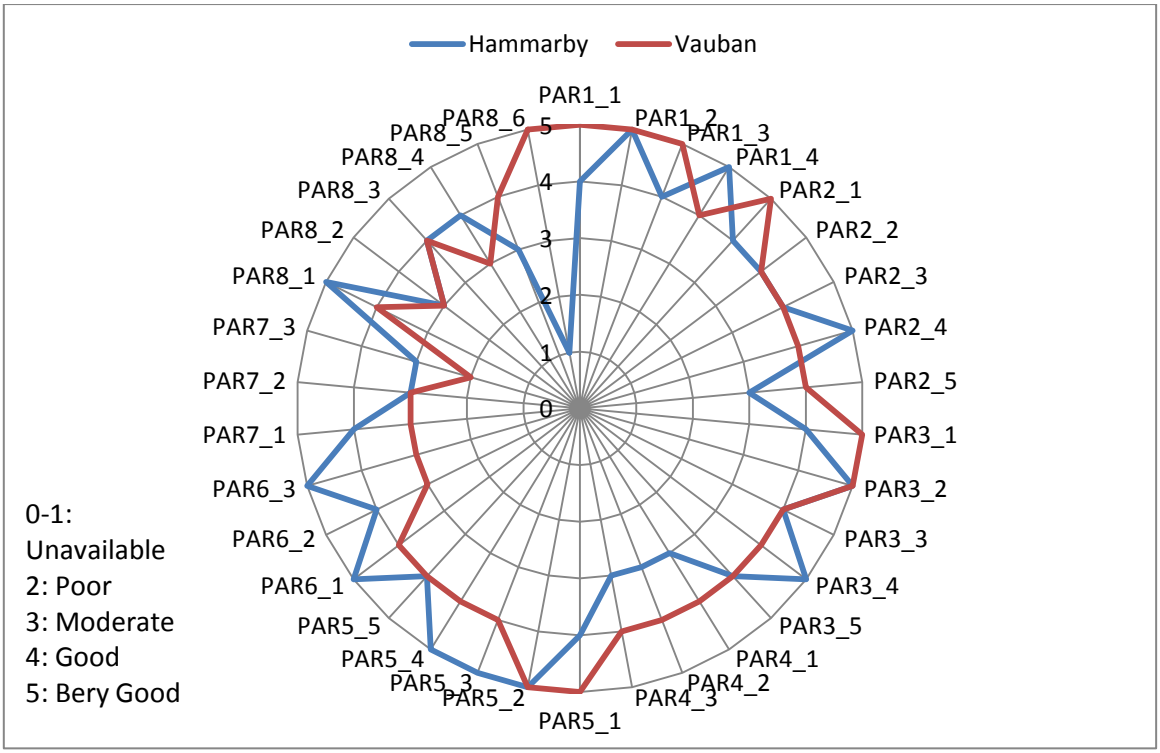


Figure 5.17: The Performance of the Practical Framework in Hammarby of Sweden and Frieberg of Germany (R. Ibrahim)

5.4 Summary

Chapter 5 has presented a practical framework of spatial patterns of 8 indicators (second objective of the research). These indicators are derived from the sustainable urban form concepts and approaches and related to urban patterns and buildings organisation. The chapter presents individually the characteristics and measurement of each indicator as the have been discussed and addressed in the available literature. The practical framework has been utilised to evaluate two sustainable communities in order to investigate its effectiveness on one hand and to clarify the role of spatial pattern in achieving sustainable urban forms on the other hand. The performances of the indicators show significant variations in both contexts which indicate the importance of this practical framework in assessing the spatial pattern of urban forms in the context of sustainability.

The next chapter tries to describe the research methodology which has been adopted by this research and illustrates the selected local case studies.

Chapter 6: Research Methodology

6.1 Introduction

This chapter describes the methodology adopted and applied in this thesis to fulfil the research objectives and answer the research questions. This chapter thus explains the approach used in the thesis to evaluate the built environment in the city of Erbil in general and the sustainable urban form of the residential districts in particular. It consists of three related components. The first part clarifies the methods and approaches of scientific research. The second part identifies the significance and contribution of research in the built environment context. The third part explores the techniques and methods which are selected to test and validate the hypotheses in order to fulfil the aims and objectives of this research.

6.2 The Research Framework

Research is an activity which aims to further knowledge by asking questions. It is to gather data, to ask, read, watch, take notes, surf the web, to find and to solve problems, evaluate alternatives, improve, allocate the best, and make predictions for future expectations (Peterson, 2000; Yin, 2009). This chapter makes an argument for locality and study specific adaptations to a range of data collection and research methods, particularly linking the artificial split between qualitative and quantitative methods, and addressing the over emphasis on scientific methods to provide an enhanced understanding of the urban form context. These methodological / data collection tools are designed themselves to form the basis for a range of linked spatial indicators, a higher level tool for simplifying measuring the sustainable urban form. Due to the contemporary nature of the built environment research, the main areas of investigation in this thesis required a range of methodological techniques to be used in order to develop a robust evidence base for each. The discussions reviewed

in Chapters 2, 3 and 4 presented the conceptual literature associated with the organisation of the built environment and the sustainable urban form outlining the main arguments behind each of these two topics. In chapter 5, a set of indicators have been formulated depending on the previous theoretical framework and two international practices. Finally, using a range of methods which draw on a range of policy, practice and participant sources, the data has been collected and analysed to present the final discussion and the implication of this study.

6.3 Research Methods

Creswell (2009) suggests that the two broad areas of research methodologies which exist are commonly referred to as deductive reasoning and inductive reasoning. Both methodologies have their own strengths and weaknesses. Leedy & Ormrod (2012) indicate that choice of methods should depend on the nature of the research problem. In addition, Zeisel (2006) argues that a combination of quantitative and qualitative research methods can provide the most effective approach in many cases but, from a critical realist perspective it is how quantitative and qualitative methods are used that is most important. Also as Yin (2009) suggests, using the multiple case study approach is more compelling and regarded as more robust to develop the arguments and to ensure the validity, reliability and effectiveness of the research.

6.3.1 Qualitative Attributes

Qualitative research methods were developed to study social and cultural phenomena. Among qualitative techniques are action research, case study research and ethnographic research (Peterson, 2000). They may include interviews and questionnaires, documents and text reviews, visuals to be analysed, as well as the researcher's impressions and reactions resulting from the researcher's observation of people’s specific behaviour in

words, gestures, and tones. Silverman (2001, P.32) states "*the methods used by qualitative researchers exemplify a common belief that they can provide a 'deeper' understanding of social phenomena than would be obtained from purely quantitative data*".

Semi-structured interviews have been one of the primary sources of data collection. The semi-structured interview will have a list of topics to be covered but no specific questions. This is a compromise between unstructured (with no set agenda) and structured (with pre-coded responses). The advantages of interviews for data collection is that they are relatively low-cost, can reach larger sample sizes and can be easy access. Limitations may be evident through misrepresentation and the understanding of local meanings (Creswell, 2009). Qualitative research is often criticised for the degree of subjectivity and lack of rigor in the techniques used. In addition analysis of data becomes more complex requiring filtering and sorting, and theory is grounded on data gradually collected and analysed (Neuman, 2000; Fellows & Liu, 2003).

6.3.2 Quantitative Method

The quantitative research methods attempt to verify theory and aim at producing universal truths and knowledge in a way that allows others to directly replicate it. This approach to research leads to continuous attention to topics able to produce quantifiable data, and in doing so excludes other data, where the objects of research are difficult to observe, in order to classify measure or delimitate measures (Creswell, 2009). Among the quantitative techniques are structured social surveys and questionnaires with closed ended questions, in which respondents answer a very rigid set of questions that allow the researcher to easily categorise information. In addition, laboratory experiments and numerical methods such as mathematical modelling, structured observation, and content analysis are also techniques adopted in the quantitative method (Neuman, 2000). The quantitative techniques have one major disadvantage in that they do not allow individuals to explain their particular

experiences. Whilst quantitative methods are strong on description, they are weak on explanation (Yin, 2009).

A questionnaire is a useful and necessary tool when conducting research of any kind. It consists of a set of questions with the intention of obtaining information related to the topic. Peterson highlights that the design of a questionnaire is one of the most delicate yet important tasks of any research (Peterson, 2000). A good questionnaire construction is critical to the success of a survey (Silverman, 2001). For instance, when seeking the necessary information, the questions should provide correct and reliable information required for reaching a decision and putting the researcher in a position to examine the theory. Quantitative and qualitative approaches involve similar processes (e.g., formation of one or more hypotheses, review of related literature, collection and analysis of data). Yet these processes are often combined and carried out in different ways, leading to distinctly different research methods (Leedy & Ormrod, 2012). Table 6.1 presents the major comparative points between quantitative and qualitative approaches.

6.3.3 Mixed-Research Approach

The combination of qualitative and quantitative methods of research is expected to reduce or eliminate the disadvantages resulting from the use of one research method while benefiting from combining both methods (Yin, 2009). Neuman adds also that the triangulation of methods is the integration of quantitative and qualitative research methods and data to produce a more complete and comprehensive study (Neuman, 2000). Yin (2009) has argued that the use of a multi-method approach to research can help safeguard against unexpected results by providing supplementary and complementary data with which to assess responses related to specific and replicable questions. However, it is acknowledged that unexpected results may actually highlight a greater level of variance in the thinking towards a phenomenon. Zeisel (2006) thus emphasises the use of a multiple

methods approach as a way of developing a flexible and responsive approach to research that incorporates theoretical and methodological foundations with the view to exploring a developing research agenda.

Table 6.1: Comparison Aspects of Qualitative and Quantitative methods (Leedy & Ormrod 2012, P.96)

Question	Quantitative	Qualitative
What is the purpose of the research?	• To explain and predict • To confirm and validate • To test theory	• To describe and explain • To explore and interpret • To build theory
What is the nature of the research process?	• Focused • Known variables • Established guidelines • Predetermined methods • Somewhat context-free • Detached view	• Holistic • Unknown variables • Flexible guidelines • Emergent methods • Context-bound • Personal view
What are the data like, and how are they collected?	• Numeric • Representative, large sample • Standardized instruments	• Texual and /or image-besed data • Informative, small sample • Loosely structured or nonstandardized observations and interviews
How are data analyzed to dtermine their meaning?	• Statistical analysis • Stress on objectivity • Deductive reasoning	• Search for themes and categories • Acknowledgment that analysis is subjective and potentially biased • Inductive reasoning
How are the findings communicated?	• Numbers • Statistics, aggregated data • Formal voice, scientific style	• Words • Narratives, individual quotes • Personal voice, literary style

Researchers often combine elements of both approaches in a mixed-method survey where various techniques from both methods can be used depending on the context of the study (Leedy and Ormrod, 2012). Developing an understanding of the intersection between theory and practice is therefore a central element of this thesis, which attempts to expand the urban pattern and sustainable urban form relation base. Therefore, the mixed method approach will be adopted for this research using different approaches so as to gain a holistic perspective of the study, as opposed to relying on one particular perspective that would reveal a narrow view of the complex issues discussed in this research.

6.4 Research Methods Adopted by the Study

The advantage of conducting a case study is that it can follow either a quantitative approach or a qualitative approach; and it can also combine both approaches, by conducting a triangulation research. For this reason, the triangulation research technique was the particular method of research which was used for this study. The research framework was accomplished through three interrelated stages.

The first stage had two aims; firstly, a holistic theoretical study on urban patterns and building arrangements and their relationship to sustainable urban forms was formulated. Secondly, the practical framework of urban pattern indicators, the factors that affected the design of the built environment and the criteria used to achieve sustainable urban forms were adopted. These factors were derived from previous related studies and they were rearranged in a new format to constitute a model, for visual analysis. Finally, through creating the theoretical propositions in the current concepts with the guidelines from the literature review, the study was able to articulate a comprehensive framework including the most effective parameters and the range of relevant values that were assigned to each parameter.

Data collection was the second phase of this study. The research data was collected through a mixed method technique which included the qualitative and quantitative surveys. The qualitative case study survey included the observational study and analysis of the urban form in Erbil city and professional semi-structured interviews with the experts involved. The first covered site visits, analysis of maps and images, describing qualities and physical features, and comparing and arranging the products in comparative charts. The second obtained all the necessary information and valuable expert’s attitudes regarding the current planning and design process of the residential projects. The purpose of the

qualitative study is to explore, explain, and describe the nature of the current local built environment. In the quantitative survey, a questionnaire survey was conducted to examine the practical framework locally and investigate the relationship between urban patterns of these residential clusters and if they are constructed according to the sustainable urban form criteria. These surveys attempted to measure the impact of urban patterns and building layouts in achieving a more sustainable context in Erbil city and to fulfil the objectives of the study.

The statistical analysis was the final phase of the research, where the data was analysed in two aspects. The first analysis focused on the qualitative analysis of visual building elements using comparative tables and graphs, while the second analysis relied on quantitative analysis (descriptive and correlation analysis). Thereafter, the outcome of the data was statistically analysed using SPSS and Excel Microsoft programs. The research results (contribution of the analysis) are illustrated in the final conclusions and recommendations.

6.4.1 Qualitative data analysis and the Evaluation Framework

The qualitative data analysis is a visual inspection method which basically aims to decide the similarities and differences that arerelated to phenomena. In addition, a primary tool in the study of the built environment, as discussed by Lynch (1960), is the visual perception which the observer builds through his or her direct contact with the different spaces and places. The purpose of the literature review in the previous chapter was to define and develop an integrated and coherent set of parameters to evaluate, detect, and monitor the sustainability of the built fabric as a basis for evaluating the current urban form in Erbil City. According to the literature review and analysis of the western experience in the cities of Hammarby in Sweden and Freiburg in Germany, eight themes have been identified to have played substantial and critical roles in the determination of the sustainability of the built

environment for the twenty first century. These could be summarised as: accessibility, connectivity, compatibility, diversity, nodality, density, identity and adaptability to cover the main issues of concern. Nevertheless, there was a little or no standardisation concerning the impact of the spatial arrangement of urban form on the process of evaluating a sustainable urban form, beyond a general acceptance of the indicators as a suitable proxy (Jenks & Jones, 2010).

The author collected data, which are used as objective measures for evaluating the current residential projects in Erbil city in terms of sustainability context. Both desk work and onsite observation were accomplished. The background information of all the cases and site maps was obtained from the relevant authorities and consultant engineering offices. The researcher selected five different residential projects: Floria City, Ashti City 2, Park View, Italian Village, and Cihan City (Figure 6.1).

Figure 6.1: Erbil Master Plan Showing the Selected Five Projects (Ministry of Municipalities, Erbil)

The selection criteria were made depending on the following aspects:

-The availability of information regarding each project and case study, and the significant role it played in shaping the built form of the contemporary city. Hence, some under construction projects were considered to be critical to the study, even though they have not yet been occupied. In such instances, the process and the impact per-occupancy on the fabric and the neighbouring users, and locality has been considered.

- Variety of urban patterns to indicate the significant variation of each indicator.

- Diversity in housing types each project offers, in terms of size, type of occupancy, and accessibility. However, the study is limited to recent construction projects, due to its contemporary nature and the prevailing economic profile of the contemporary city. This has limited the amount of social housing produced in the city and hence, considered in this study. This is largely due to the predominance of the high-income group housing projects (chiefly compounds) that dominate the landscape of the planned urban fabric in the city.

- Different building and population density.

- Variety of location depending on the proximity to the city centre.

- Variety of date of construction since two of the projects was under construction and unoccupied (Floria City and Cihan City). The others have been occupied since 2008 (Italian Village, Ashti City 2, and Park View). In order to achieve a holistic study regarding the contemporary residential construction of the city and attach the housing production with the recent sustainable urban development, the researcher intentionally has chosen these projects to indicate past, current and the future development characteristics. To this extent, the study will be able to formulate a comprehensive conception, procedures and actions to ameliorate the current conditions and the future of the built environment of Erbil city.

The discussions in the previous chapter illustrated the main aspects to be considered under each of the research themes. These translated into the key performance indicators that worked as tangible proxies and were employed as part of the evaluation. The key evaluation indicators, which are referred to as “parameters” and abbreviated as “PAR” in this study, are presented in an empirical checklist (Appendix 1). These parameters are collected in one coherent framework for visual analysis to create a base for qualitative survey, investigate the performance of each indicator, and answer the fifth research question. The evaluation of each factor was performed subjectively or by visual and measurement analysis depending on the factor as mentioned in chapter five. Many factors were neutralised in the uncompleted project since they were related to user’s activities in the site like vibrancy and dynamic activities and amenities.

According to Creswell (2009) and Yin (2009), the method of qualitative analysis was conducted through the following steps:

a) Prepare and organize site maps and image data of the selected projects.

b) Arrange the parameters into comparative framework tables to indicate the characteristics of each factor.

c) Site visit, visual observation, and physical features calculation.

d) Describe, compare and analyse the performance of each parameter (the analysis of the data was conducted through the SPSS and Excel programs).

e) Finally, the data will be represented in figures, tables, and descriptive discussions.

6.4.2 Sampling

Sampling is a process of choosing a small group from a larger group of population in order to estimate or predict the occurrence of an unknown piece of information, situation or

outcome that is related to the larger sample (Leady & Ormrod, 2012). Accordingly, due to considerations of time, cost and security risks in Erbil during the turbulent period of armed conflicts and terrorism in the region, it becomes difficult and impractical to undertake broad surveys of a large number of the population in this research project and, consequently inferential statistics are used and subgroups of users that meet the criteria for the case study locations have been selected.

In the case of the questionnaire, the sample population was randomly selected regarding the residents (users) and the experts. The questionnaires were handed personally to each user who promised, in return, to hand it over within one week (when finished) at the security office at the main gate of each project due to some safety measures at that time. Regarding the academic students and the experts, the case was less complicated since plenty of questionnaires were distributed depending on the number of respondents and collected by a selected person. The number of distributed questionnaire was 200, but only 140 users responded successfully. Regarding the other sample of academic students, scholars, planners, and decision makers (experts), the number of distributed questionnaire was 200, however only 112 experts responded positively (Table 6.2).

Table 6.2: Distributed Questionnaires and Respondents

Occupations	Numbers Distributed	Number of Responses	Percentage
User of Ashti City 2	70	48	
User of Italian Village	65	57	
User of park View	65	35	
Total Users	200	140	70%
Planners and Architects	80	60	
Stakeholders and Decision Makers	20	12	
Scholars and Academic Students	100	40	
Total Experts	200	112	56%
Total	400	252	63%

In the case of the interview, random sampling is not used but focus groups or purposive sampling (Creswell, 2009). The logic of the purposeful sampling lies in selecting information-rich interviewees. This means that the elite members of the community who will provide the survey with the best information have been chosen. Many criteria have been considered in selecting the applicants like: position in the decision making, academic qualifications and professional experience. Therefore, 20 of decision makers, planners, architects, stakeholders and academic professors who are were contacted. However, only 14 interviews were conducted since many have apologised at the last moment due to different reasons.

6.4.3 Questionnaire

The art of designing a questionnaire consists of thinking about the research issue in terms of what the concepts mean and how the data will be analysed. Furthermore, the mode of questionnaire administration is evaluated. The design of a questionnaire depends on whether the researcher aims to collect exploratory information -that is qualitative information for the purposes of better understanding or the generation of hypotheses on a subject- or quantitative information -to test specific hypotheses that have been generated previously- (Creswell, 2009).

In the case of the questionnaire design, the main aim was to test the first hypothesis regarding the relationships between urban patterns and their role in achieving sustainable urban forms. In addition, the questionnaire aimed to evaluate the current local built environment in Erbil City and answer the fifth research question which explores the performance of urban patterns indicators locally. The design of the questionnaire was based on the literature, and modified in response to the opinions of project advisors and experts in the field. The questions were divided into two sections, the first part focused on general information regarding the respondents while the second part concentrated on

evaluating the current locally built environment through the assessment of the urban pattern indicators. Moreover, there were two types of questionnaire, the first responded to by the residents of the recent residential projects (Appendix 6). There were only 16 questions that related to the eight indicator themes. Most of the questions were accompanied by specifications to provide further explanation of the questions. While, the second type of questionnaire which was responded to by the experts included 31 questions (Appendix 7). The questionnaire addressed the variables of each indicator, which have been discussed in the previous chapter, completely.

The questions that particularly dealt with gathering information on applicants' assessment of the current residential projects required elaboration beyond multiple choices. Some of these questions were associated with an assessment scale mainly consisting of five grades or ranks (Likert Scale). Participants were asked to mark the scale to show the level of their satisfaction or dissatisfaction with the quality of each indicator regarding the local neighbourhood characteristics. One of the important objectives of the questionnaire is to answer the third research question regarding the impact of urban pattern and layout on the on achieving sustainable urban forms in developing countries. Moreover, the questionnaire intends to reveal how each indicator is practiced and performed locally which is the answer to the fifth research question. To examine this relationship, the one-way ANOVA analysis was conducted. This test analysed the variation within and between groups or categories of data using a comparison of means to test if all the means are the same or two or more means are different from the others.

Due to the fact that the respondents' local language is Kurdish, the questionnaires were available both in English and Kurdish languages (Appendix 8). To avoid language barriers and time limitations, the majority of the questions were closed questions which were estimated to last between 15-20 minutes. The format of the questionnaire had been tested

and developed before distributing the questionnaire. In order to obtain a clear view of the relative defects, a preliminary informal test of the questionnaire was carried out before starting the main survey. The questionnaires were distributed and collected (November 2014-February 2015).

6.4.4 Interview

An interview methodology was considered the most appropriate approach to data collection directly with the participants compared to questionnaires or focus group discussions, as it enabled a range of respondents to be surveyed using a number of grounded principles and concepts based on the most recent findings and assumptions of the built environment research (Neuman, 2000).

The interview consisted of two stages: a preliminary interview and an in-depth interview. The former was carried out (with most of the residents) simultaneously with the questionnaire survey. Questions were asked about the reason for each evaluation the respondents gave in the questionnaire, which could help to collect more detailed information to understand the evaluation mechanism of the applicants. Some of the respondents expressed their opinions and perceptions of the current planning and urban forms issues in the city of Erbil that were not included in the questionnaire. For those respondents who were willing to participate in the in-depth interview, a face-to-face interview was performed in their work places simultaneously. The semi-structured interview was based on the three spatial levels. The first level discussed the personal experiences, problems and the expected future actions of the current built environment in Erbil city. The organisation of urban forms and the related sustainable indicators were the main core content of the second level. The last group of questions focused on specific details regarding the context of sustainable urban forms (Appendix 9).

The interviews were conducted with decision makers, managers, scholars and consultant architects and planners (Table 6.3).

Table 6.3: Interview List in Erbil City (December 2014-February 2015)

No.	Candidate Name	Occupation	Date and Place	Notes
1	Interviewer 1	Academic	22/12/2014 Office	
2	Interviewer 2	Consultant Manager	29/12/2014 Office	
3	Interviewer 3	Consultant Architect	05/01/2015 Office	
4	Interviewer 4	Academic	12/01/2015 Office	
5	Interviewer 5	Decision Maker	14/01/2015 Office	
6	Interviewer 6	Academic	15/01/2015 Office	
7	Interviewer 7	Academic	19/01/2015 Office	
8	Interviewer 8	Decision Maker	21/01/2015 Office	
9	Interviewer 9	Consultant Planner and Architect	22/01/2015 Office	
10	Interviewer 10	Academic	26/01/2015 Office	
11	Interviewer 11	Decision Maker	27/01/2015 Office	
12	Interviewer 12	Academic	29/01/2015 Office	
13	Interviewer 13	Consultant Manager	02/02/ 2015 Office	
14	Interviewer 14	Academic	05/02/2015 Office	

Face to face interviews also allowed for additional discussions in which to collect more information on the open ended questions depending on the receptiveness of the respondents and their time availability. Furthermore, this method avoided the chances of illegible or incomplete questionnaires. Having completed the surveys, a discussion was held among the interviewers and author to get feedback on any additional information and discussions by the respondents. All respondents that were contacted showed enthusiasm about the subject and were happy to share their opinions. Each interview was between 30 minutes and one hour in duration, to prevent interviewee fatigue. Before starting the interview, the researcher gave each participant an outline of the background of the study and the way in which the information was to be used. In addition, each interviewee was briefed on the issue of confidentiality and was asked for approval to participate in the research (Appendix 10).

6.5 The Case Studies

The survey of five residential case studies has offered valuable data for an in-depth study. Data has been gathered to cover urban layout, physical form and the ability of each case study to meet the criteria of sustainable urban forms. Site surveys involved the observation of urban characteristics and qualities, and measurements of the sustainable indicators through a prepared checklist. As mentioned before, the five projects were selected according to many interrelated criteria which include variety of building arrangements; mixed-residential type; diversity of location; the proximity to the city centre; and the availability of information. Two of the selected projects are under construction (Floria and Cihan City), two are half resided (Ashti City 2 and Park View) and the last is completely inhabited (Italian Village). The eight indicators were tested in each site by personal observation, measurement and visual analysis. In this section, basic information and analysis of data for each case study have been presented in order to provide a general vision of the status quo and facilitate the evaluation of the local built environment. Moreover a comparative analysis is provided to investigate the general characteristics of every project.

6.5.1 Site One: Floria City

Floria City is an integrated and comprehensive urban neighbourhood consisting of commercial, office and mixed-residential functions. The location lies about 7 miles east of Erbil city centre, directly on Koya main road (Figure 6.2). The project is under construction now and is predicted to be finished in 2017. This location and most of the surrounding areas were agricultural lands for many decades, and left vacant after the rapid expansion of the city in the eighties.

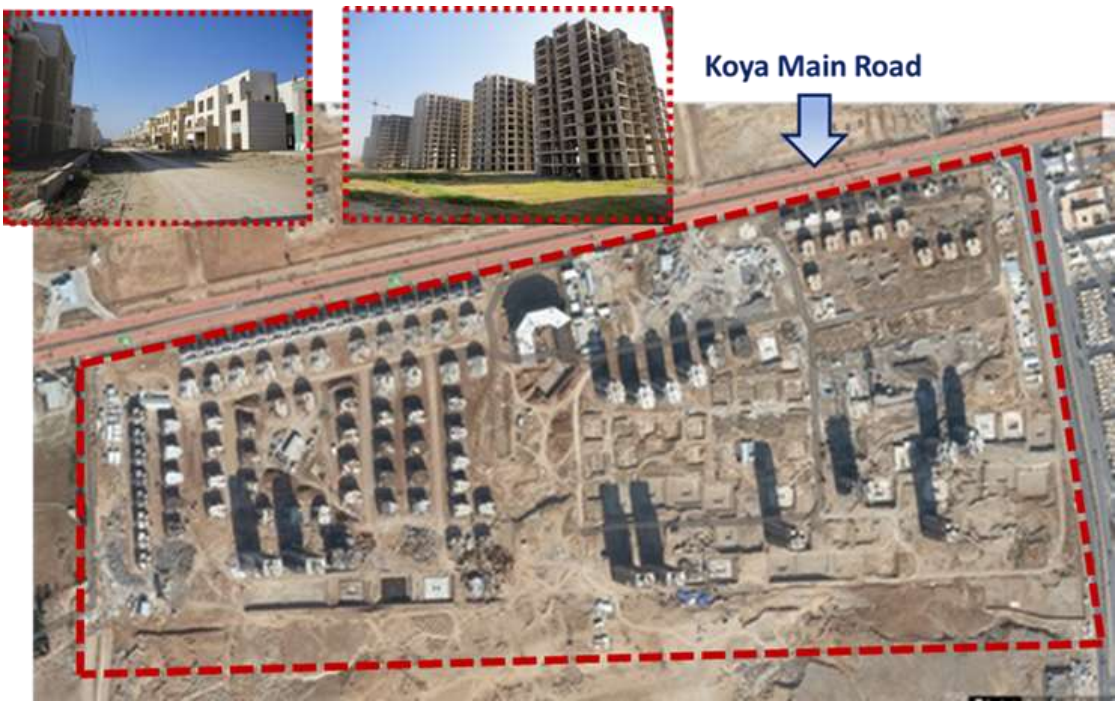


Figure 6.2: Floria City in Erbil (www.googlearth.com)

The project is connected to the main road through a ring collector, which allows for penetrating the area through many guarded gates from the north, south, and east side. In order to satisfy the demands of parking, a central underground parking lot is designed and will be constructed. In addition, many parking areas are designed near the residential blocks. A multi-functional polygonal building with various administration and leisure facilities is located in the centre of the community.

The main concept behind the project is to create a diverse distinctive community. The designer has introduced and overlapped a dynamic and organic movement to break the static repetitive grid structure (Figure 6.3). Hence, the type of urban layout and building organisation is a combined grid-central-linear pattern where the public activities are located in the centre; a grid pattern of low residential houses are located to the west, and a curvilinear pattern of high-rise buildings are placed to the east (Figure 6.4).

Figure 6.3: Floria City Site Plan (Floria Project Engineering Office)

Figure 6.4: High-Rise Residential Towers in Floria City (R. Ibrahim, 2014)

There are many interrelated characteristics that would enhance the quality of the project like: the hierarchy of internal streets and high accessibility of the residential buildings. The standard and quality of the public facilities and landscape are distinctly better than the other four cases. The community management and maintenance are offered to a high standard according to the project manager. However, there are many issues which should be

considered like: the social interaction within the community and with the adjacent neighbourhoods, the lack of local identity and sense of place, and the involvement of people in the preliminary planning and design process.

6.5.2 Site Two: Ashti City 2

Ashti City is a modern mixed residential complex, composed of 1100 residential units of low- rise dwellings (which are mostly occupied now) and high rise buildings which are under construction (Ali and Basil, 2015). The location lies approximately 9 miles east of the centre of Erbil on Kasnazan main road (Figure 6.5).

Figure 6.5: Ashti City 2 in Erbil (www.here.com)

The historical background of the land refers that it was an agricultural area till the late eighties, when the city rapidly expanded in all directions, and left as vacant land. The project started in 2006, many phases are completed like the single family houses, and the high-rise zone is still under construction. The project has faced many financial and political issues which have resulted in continual delay of completion of the project. The main idea behind the concept was to provide an affordable and diverse community through the combination of different building types which are connected through the landscape in one

quiet location. The urban layout of the project is central with multiple- direction grids on the west and east side. The public services and facilities are distributed between the centre and the edges. The site is divided into two parts and connected by the internal main road which links with a collector ring road (Figure 6.6).

Figure 6.6: Detailed Site Plan of Ashti City 2 (Iskan Company)

The residential blocks lack distinctive architectural style and facade design; the majority of housing elevations are similar and monotonic which results in the loss of local identity and sense of place within the community (Figure 6.7).

Figure 6.7: An Aerial View of Ashti City 2 (Iskan Company)

As mentioned before, social privacy, population safety and comfort are fundamental composite indicators of achieving sustainable and liveable communities. There is a lack of privacy in the high-rise zone and a lack of adequate pedestrian pathways near the single family house zones**.**

6.5.3 Site Three: Park View

Park View is a distinctive high-rise buildings complex comprised of 12 towers (982 apartments) each with 18 storeys of combined residential, commercial, offices and entertainment facilities. This gated community lies between the 100 m Ring Road and the 40 m Ring Road about 3 miles north-west of the city centre of Erbil and 2 miles to the west of the airport (Figure 6.8).

Figure 6.8: Park View in Erbil (www.Googlearth.com)

The whole location has two main guarded entrances (east side and south) and is enclosed by service and commercial activities (ground and first floor) from the south side and by walls from the other sides. The land was a military training base many decades ago and left vacant after the prosperous development in the area. The buildings are connected to Gulan

Street through the internal road to the north. Car parking is arranged on two levels, the ground level to the north between the buildings and basement level to the south under the commercial storeys. The open spaces and playgrounds are located in the dispersed areas between the towers. As mentioned above, most of the project's facilities are located within the south buildings and occupy two storeys (Figure 6.9). Most of the towers (80%) are completed and ready to occupy and the others are under final construction and are supposed to be finished in 2016.

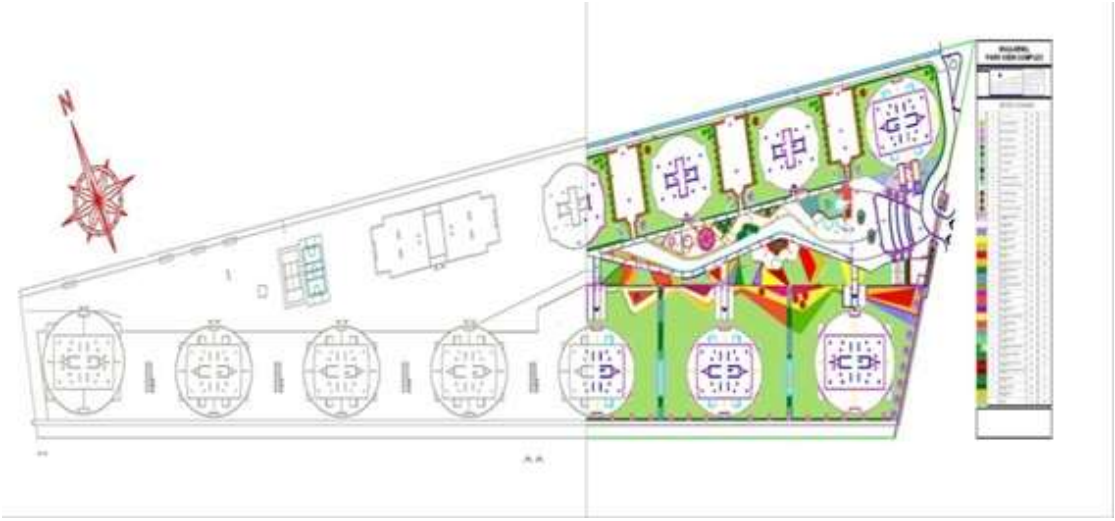


Figure 6.9: The Site Plan and Urban Landscape in Park View Project (4M Company)

The urban pattern and the organisation of the towers are of a linear type where the buildings are lined up in two rows with open spaces, green areas, and car parking in between. The main concept of the project is to provide a prestigious high-rise community in one of the most important parts of the city. Moreover, the cylindrical forms of the towers and continuous openings have offered an impressive skyline and provided a protective and safe internal environment (Figure 6.10). The project has been exposed to many criticisms regarding the loss of human scale, the lack of adequate open spaces, lack of privacy, and undefined local identity. However, there are many optimistic features which have been considered thoroughly like: the imageability of the mass, compactness, safety and security, and the high quality of the built environment.

Figure 6.10: 3D Perspective Showing Gates and the Commercial Storeys (4 M Company)

6.5.4 Site Four: The Italian Village

This neighbourhood was originally laid-out and constructed by the Hemn Group in late 2008, with the aim of offering a distinctive luxury community in one of the most important areas in the city and completed in 2010. The project is comprised of 659 housing units and has attached and semi-detached units. The area is located between the 100 m Ring Road and Gulan Street approximately 2.5 miles west of the city centre and 2 miles south west of the airport (Figure 6.11). The land was considered an important military camp due to its strategic location, then it was left as a vacant area till 2007.

The planning pattern is a combined curvilinear-grid articulation of dwelling blocks based on a central internal road and secondary narrow streets to create a tree shape concept which takes into consideration the separation between private zones (residential) and public zones (Figure 6.12). This walled modern community has two main entrances and consists of two types of housing for residential, local and international offices (two-floor buildings) besides it contains various public services (one- floor buildings) like a primary school, shops and a mosque.

Figure 6.11: Italian Village in Erbil (www.here.com)

Figure 6.12: Italian Village Site Plan (Hemn Group Report 2006)

The first main entrance lies to the west of the district on the 100m Ring Road. Inside the project, after the check point, the main central street leads to the central location where the public services are provided. The second entrance lies to the east, after the check point, it penetrates through a group of attached two floor houses to reach the public area. The high quality of living, wide streets and pathways, safety and security formulate the first positive impression (Figure 6.13). However, lack of car parking, undefined open spaces and

children's playground, and repetition of western elements are the main undesirable characteristics of the project. Nevertheless, the Italian Village remains one of the most attractive and valuable residential communities in the city.

Figure 6.13: The Luxurious Single-Family Houses in the Italian Village, Erbil (R. Ibrahim)

6.5.5 Site Five: Cihan City

Cihan City is a high-rise residential gated community occupying an area of 93 hectares, comprised of 16 towers with a total of 1404 apartments. The project is considered one of the significant projects since it is located 5 miles south of the city centre, precisely on Rasty Road and the recent 120 m Ring Road, near the main road to the capital Baghdad, and proximate to many educational and technical institutions (Figure 6.14). Moreover, the height and imageability of the buildings (15-23 floors) provide a distinctive skyline from the southern side of the city. The land was one of the fertile agricultural lands a few decades ago and remains a vacant neglected area after the rapid growth of the city. The project was laid out in 2013, half of the towers are almost finished and the rest are to be completed next year.

Figure 6.14: Cihan City in Erbil (www.here.com)

The main concept of the project is to create a high-rise walled community in a very sensitive location with the purpose of improving the quality of the built environment in the city. The urban layout and the site plan show an arrangement of 16 high-rise buildings creating well-defined clusters of semi- private solid-void zones which surround the central public zone (Figure 6.15).

Figure 6.15: Cihan Residential Campus Site Plan (Cihan Construction Group)

There are three main entrances which are connected to the internal ring road. The entrance from Rasty Road is almost completed (Figure 6.16), while the others are under

construction. Due to the limited available area, the public facilities like a multi-storey mall, primary school and a mosque were located on and dominated the north side of the project.

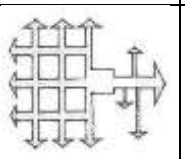
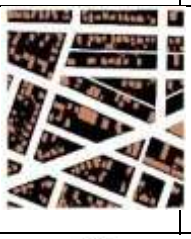
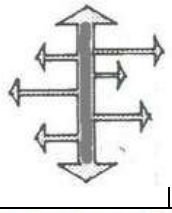
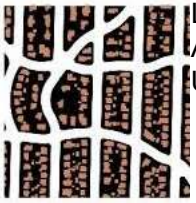
Figure 6.16: The Main Entrance to Cihan City, Rasty Road (R.Ibrahim)

The main critical issues that this project is facing are the loss of human scale, undefined open spaces for social interaction, the unreasonable locating of local services, and the lack of local identity. This may be due to incompatibility between planning, design concept and the available site area. However, there are many important defined characteristics that can be justified in this vital project, such as the legibility and its impact on the city sky-line since it is considered an important façade of the southern gate of the city. Moreover, the inspiration to implement high-rise and compact projects which would reduce land consumption and minimise the pressure on the congested city centre.

As mentioned before, many features and criteria were analysed to compare and evaluate the current built environment. The comparison depended, in the first place, on selecting different types of urban patterns to examine the differences on one hand and to address the role of the spatial pattern on the other hand. Variety of location, density, diversity of housing

types, quality of design and date of construction were among those criteria that have been taken into account in selecting the case studies (Table 6.4). Figure 6.17, 6.18, and 6.19 display more analytic charts of population size, area, and the net population density variation in the five selected cases.

Table 6.4: Characteristics of the Selected Residential Projects in Erbil City

Pro. No.	Name	Type of Layout	Form of layout	Residential type	Distance to the City Centre	Population Size	Area M^2	Density Per/Hec
1	**Floria City**	Mixed Grid-Linear Pattern		Mixed High and low Rise Units	7 miles	16200	628700	257
2	**Ashti City 2**	Multiple Grid Direction		Mixed High Rise and Detached Units	9 miles	6900	75000	920
3	**Park View**	Linear		High Rise Towers	2.5 miles	4750	49250	990
4	**Italian City**	Multiple Grid-Curvilinear		Low Rise Attached Units	2.5 miles	3300	42500	776
5	**Cihan City**	Cluster Pattern		High Rise Towers	5 miles	7000	93000	753

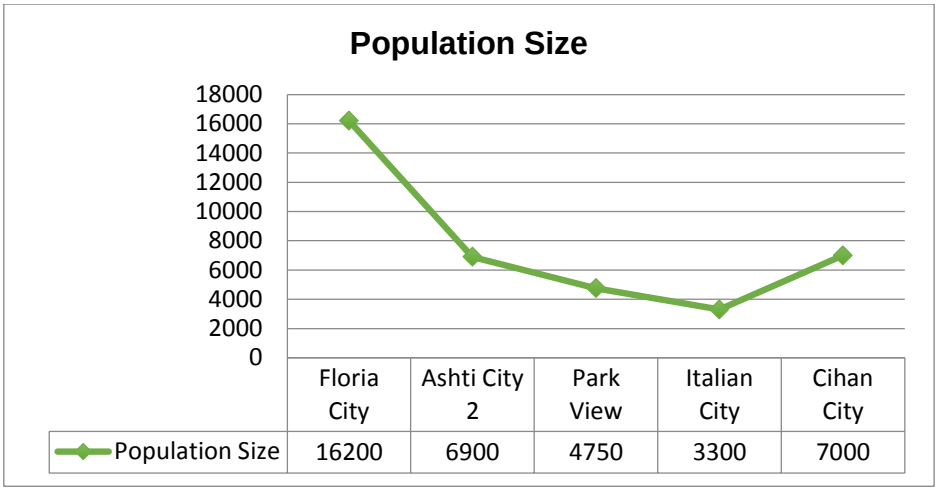


Figure 6.17: Population Size Distribution of the Selected Projects

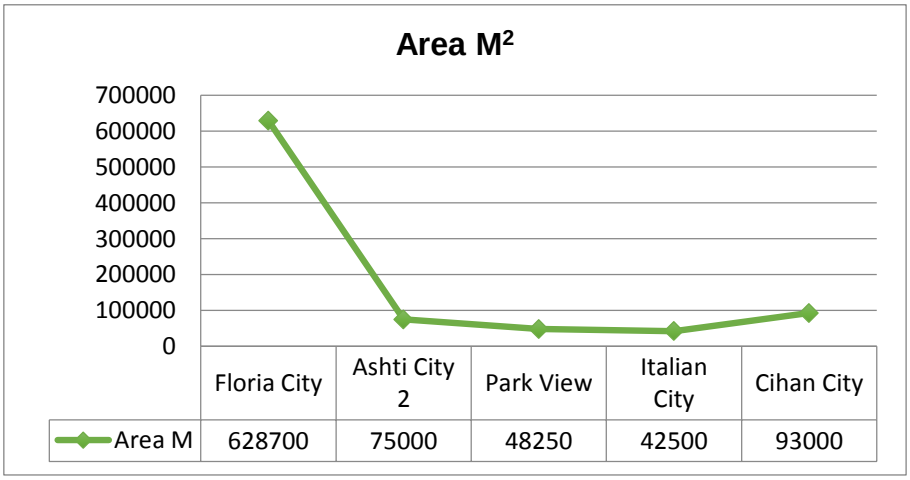


Figure 6.18: Site Area Distribution of the Selected Projects

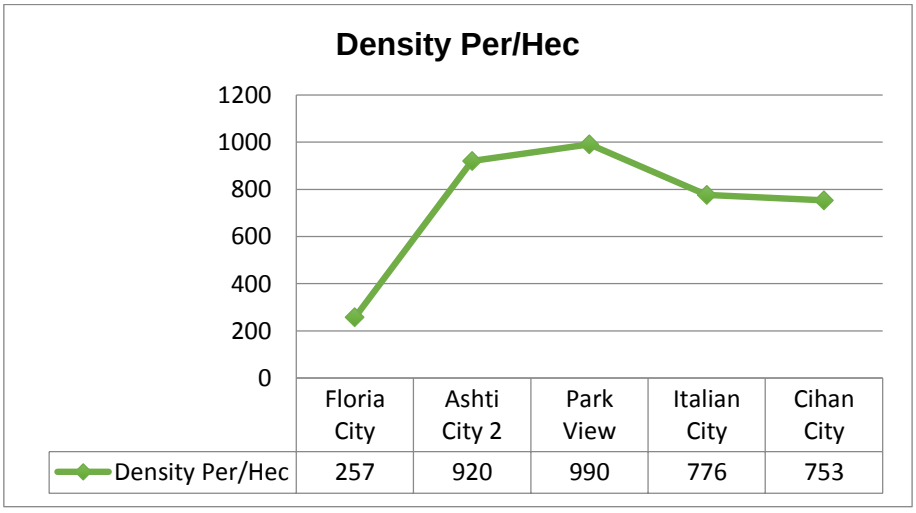


Figure 6.19: Population Density Distribution of the Selected Projects

6.6 Analysis of Data, Validity and Reliability of Measurement

Penn (2008) describes research on the topic of sustainable development in general and in the context of the sustainable built environment, as contexts which will not always be static or sufficiently similar and having variables which will be impossible to control. It is important to establish the appropriateness, quality and accuracy of the procedures adopted for finding the answers to the research questions.

The analysis and interpretation of the collected data was targeted to describe, explain, and evaluate the present situation of the residential projects in Erbil City. To analyse the data from both the quantitative and qualitative surveys, inductive and deductive approaches were used. For the quantitative survey, the nominal level of measurement was employed as the basic method for analysing collected data. With regard to the qualitative survey, the analysis of the semi-structured interviews and other data such as photographs, maps and visual analysis was mainly based on an inductive approach in order to identify key themes and then synthesise the result into textual narrative. The data was constantly analysed regarding key events, facts and feed-back. Analytical reasoning also took place while interviewing and observing the selected neighbourhoods as case studies.

For this study, the questionnaire and the field work assessment of the residential projects were the most important methods used to gather the quantitative data. Therefore, in this regard, quantitative analysis will form the basis for analysis and presentation of results. The collected numerical and verbal transcripts were coded and presented using two methods of analysing questionnaire and interviews. As mentioned before, this study used appropriate programs like SPSS and Ecxel to process and analyse the data from the questionnaire survey. The quantitative data will be investigated also by these methods:

- Descriptive analysis: This method involves providing an overview of the respondents regarding the common characteristics of the local built environment.

- Analysis of Variance or one-way ANOVA Technique: An ANOVA is a statistical test available on SPSS that enables the mean differences between the values of the survey sub-groups to be tested.

- Comparative analysis: This technique of analysis will be used to explore the similarities or differences (The T-Test was also implemented to test the disparity of responses) and to measure the degree of association between the values of related features.

In terms of measurement procedures, Leedy and Ormrod (2012) argue that validity is considered the most important aspect. In this research, conducting a literature review regarding urban pattern and its role in achieving sustainable urban forms is the main source for attaining content validity. Accordingly, the questionnaire was revised by a group of academic professionals regarding the content, language, transparency and suitability of the questions. In addition to that, the collected data from the users and the experts were compared with the data from the qualitative field work by the researcher to ensure that the highest correlation coefficient existed between the results. Finally, to achieve the construct validity, this procedure is identified through formulating a valid relationship between theoretical framework and the related items measured in the questionnaire or the practical framework.

Neuman (2000) argues that the reliability of the quantitative research has repeated measurement, stable and consistent. The greater the degree of consistency and stability in an instrument, the greater is said to be its reliability. Moreover, Creswell (2009) adds that researchers should ensure the reliability and validity of the research instrument and procedures in the early stages of their research. The idea behind reliability is that any significant results must be more than a limited finding and be inherently repeatable. Without

this replication of statistically significant results, the experiment and the research have not fulfilled all of the requirements of testability. However, the questionnaire has taken into consideration the wording of questions, the physical and context setting, the respondent's and interviewer's mood, and the nature of interaction. Furthermore, the quantitative study concentrated on using random samples whenever possible, utilizing appropriate sample sizes, avoiding biases, and has not been influenced by funding or desired to seek certain results.

6.7 Summary

Chapter 6 presents the research methodology which intends to provide a description of the exact actions, plan, or strategy to be used to answer the research questions. According to the research problems, questions and context, the mixed methods design is chosen. The chapter represents also the different tools that were adopted by the researcher to the required data. Finally, the chapter illustrates the important descriptions and characteristics of each case study. Qualitative analyse of each project are organised in a comparative table depending on pre-selected criteria and indicators like: the urban pattern, location, density, diversity, and the design quality.

In the next chapter 7, the study highlights the urban development of the research context. The city of Erbil is the main focus, and the recent related statistics are mentioned accordingly.

Chapter 7: The Urban Development of Erbil City

7.1 Introduction

This chapter explores the layers of historical, spatial and social developments of the contemporary urban context of Kurdistan in general and of Erbil in particular. The chapter presents briefly historical background and urban transformation of the city through the ages. Moreover, it demonstrates how the city has developed. Finally, the chapter addresses the most important local planning and housing characteristics as a reflection of the changing status of the city, the polarisation of Iraq and emerging of neoliberal urbanism.

7.2 The City of Erbil

After living for decades in unstable conditions, the three northern governorates of Iraqi Kurdistan, Erbil, Dohuk, and Sulaymaniyah, experienced autonomous status and self-management for the first time in 1991 as a consequence of the successful uprising of Iraqi Kurds and the removal of Saddam Hussein's regime (Stansfield, 2003). Erbil, the historical city and the capital of the Northern Province of Kurdistan Iraq, is going through fundamental changes due to the influence of political, economic, global, cultural and demographic transformations (Figure7.1). Yasin (2011) highlights that Autonomous management of resources and revenues along with economic prosperity have allowed the city to accelerate its reconstruction and development, enjoying more stability and a safer environment in comparison to other cities in Iraq. However, the rise in private investments and intensive planning has been counterproductive when it comes to the built environment of this ancient city. Nooraddin (2012) adds that Indifferent modern planning, architecture and the urbanisation of wide streets with high-rise buildings of business establishments have created disarray in the physical form, in which both old and new, the traditional and the modern appear alien to each.

There has been growing dissatisfaction with recent development projects and new compounds around the old city over the lack of planning vision (Ebraheem, 2013).The predominantly unplanned growth has been incidental and does not constitute a sustained approach but that inscribed by unpredictable implications of the growing population and increasing economic assets (Rydin, 2010). This chapter explores historical, physical and social layers which accompany those transformations. Although the current urban context of Kurdistan in general and of Erbil in particular is evidently closer to being thought of as a mere production of neoliberal policies, the debate however on globalism and modernism versus traditional and cultural is on-going.

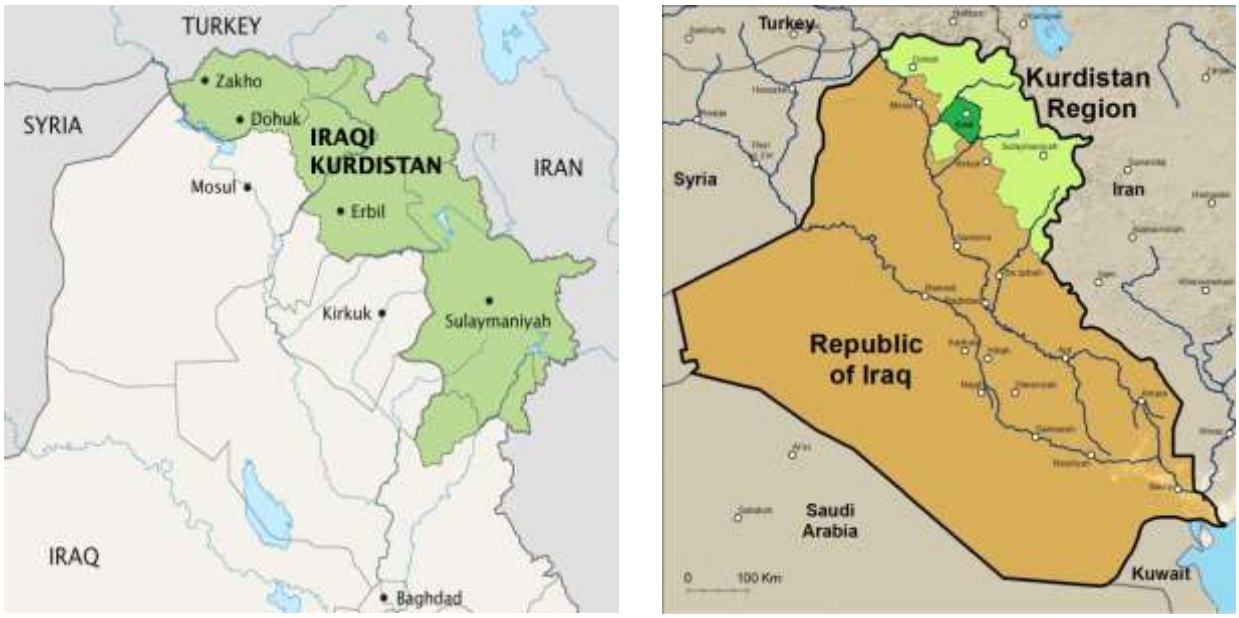


Figure 7.1: Iraq Map Showing Kurdistan Region, Erbil and Main Cities.

(http://asorblog.org/2013/11/16/new-explorations-in-the-heart-of-assyria-cities-and-landscapes-on-the-erbil-plain-kurdistan-region-of-iraq/)

7.3 Narratives of Historic Developments

The Kurds are one of the oldest nations in the Middle East, distinct from Arab, Persian and Turkish neighbours. Scholars agree that the Kurds are descendants of a mixture of Indo-European people formed from indigenous inhabitants and subsequent immigrants who have settled in the region for more than three thousand years (Gunter, 2011). Their history

stretches from 3000 to 400 BC as a period of severe disturbances between Kurdistan and the neighbouring powers such as the Assyrian and Persian Empires. The Kurds, then known as the Gutis, were able to establish a ruling dynasty in the region between 2250 and 2120 BC. For the next fourteen centuries and after the fall of the Gutis, however, Kurdistan was a scene for military invasions, plots, and destruction as a result of the rivalry between the Ottoman and Persian empires. These conflicts drove the region into social and economic unrest that soon led to the transformation of Kurdistan (Meho, 1997).

Kurdistan, or the land of the Kurds, is located in the strategic and geographic heart of the Middle East where Central Asia, the Arabian Peninsula and Southern Europe meet. Today it comprises important part of Turkey, Iran, Iraq, Syria and Azerbaijan. It has long been denied independence, but most scholars describe Kurdistan as the area in which Kurds constitute an ethnic majority (Gharib, 2004). Kurdistan was first divided in 1514 AD between the Ottoman and Persian Empires. Four centuries later, Britain and France further altered the political contours of Kurdistan by dividing the Ottoman Kurdistan into three main parts. The partitioned area consisted of more than 190,000 square miles divided as follows: Turkey (43 percent), Iran (31 percent), Iraq (18 percent), Syria (6 percent) and the former Soviet Union (2 percent) (Aziz, 2011).

The city of Erbil is located on enormous fertile plains of 15870 square km known as “Dashti Hawler” between the Great Zab and the Lesser Zab rivers. It has kept the same name throughout history while the tribes in this region, followed the Zoroastrian religion until the appearance of Islam in the seventh century (HCECR, 2009). The first historic record dates back to Neo-Sumerian times when the kings of Ur attacked Erbil from 2094 to 2046 BC and 2046 to 2038 BC, but failed to conquer the city. Erbil was mentioned for the first time in the Sumerian holy writings (about 2,000 BC) as ‘Orbelum’ or ‘Urbilum’ and in the Arab and Assyrian texts as ‘Arba-Elu’ (Gharib, 2004). The loss of prominence had occurred in the

13th century when the Mongol, Persian and Turkish conquest took place. In the following centuries, Erbil was marginalised and in the 19th century the population ranged between 3000 and 6000 inhabitants, mostly living in the ancient fortress, the Qala'a (Sherzad, 1979).

The Castle or the Citadel is known as an authentic example of urban civilisation which developed in the region in the 6th century B.C. This historic heart of Erbil was not a citadel in the sense of being not only a military/administrative feature, but being the urban core which was incorporated into a single settlement unit with the separately fortified city on the plain (Aljanabi, 1987). This citadel was built on layers of archaeological ruins which represented sequential historical settlements with an irregular oval in plan (Figure 7.2), the crown measuring 430 x 340 m (total area roughly 102,000 m2), which rises some 25–32 m (82 -105 ft.) above the flat (KRG, 2007).

Figure 7.2: The Oval Shape of Erbil Citadel, View from the North Side (HCECR, 2009)

Sherzad (1979) describes the urban fabric of the Citadel as a tortuous pattern which was distinguished by its tree-shaped pattern and divided the plot into three districts (or mahallas): the Serai, which was occupied by the wealthier families; the Takiya, area of Sufi houses and dervishes; and the Topkhana, which was resided in by artists and farmers

(Figure 7.3). The citadel was considered an independent city with markets, mosques, baths, dispensary and schools. Khoshnaw (2016) indicates that their inhabitants were displaced to the east of the city in a new quarter called New Citadel quarter.

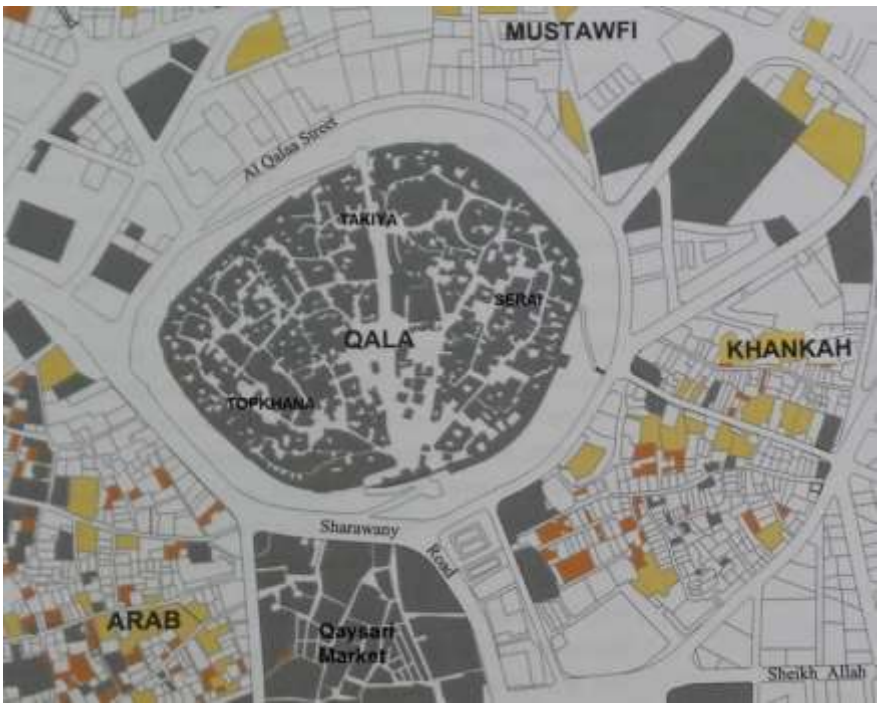


Figure 7.3: The Organic Pattern of the Citadel, Inner and Surrounding Districts locations (UNISCO, 2011)

7.4 Erbil Urban Transformation

In spite of the urbanisation and modernisation that has occurred in the city of Erbil over the past few decades, the greater part of the historic fabric of the old Citadel and its architectural heritage are still well-preserved, especially if compared to other World Heritage cities of the Arab World. This reflects the extraordinary role of UNESCO and the Kurdistan Regional Government in maintaining the historical and cultural heritage of Erbil City. Yasin (2011) argues that he city has passed through distinctive historical and architectural eras, during which several factors have affected current forms of the built environment and the city's identity. The political and economic prosperity and the flexibility of the city's master plan (central-radial) have contributed to smooth and gradual expansion.

According to HCECR (2009) report, changes that Modern Erbil has experienced can be elaborated in five definitive periods; the Pre-industrial City before 1900 (Ottoman Period), Early Modernity 1900-1940 (Pre-Modern Period), Post-modern City and Materialism (1940-1980), The Autonomous City (1980-2003), and Finally, the Neo-Liberal Economic City (since 2003). This period has witnessed flourishing and unprecedented social and economic mobility with vast investments and growing oil revenues. Wealthy quarters and exclusive compounds have taken shape along with several office buildings and business centres. Western metaphor dramatically dominated many buildings and residential settlements (Figure 7.4).

Figure 7.4: The Contrast in Modern Buildings of Erbil (R. Ibrahim)

7.5 Urban Development of the City

Erbil city gained its highest administrative state and became a capital city under the reign of Atabeg (1190 to 1232). In 1840, when Ainsworth visited the region, Kirkuk and Erbil were considered towns attached to the province of Baghdad (Ainsworth, 1891). In the early 1930s, there were 70 villages around Erbil city. Seven neighbourhoods constituted Erbil,

three in the citadel and four around it. The number of mosques and churches was 12 with 4 takyas, 6 schools, 1822 houses and 3 baths (Isa, 1922).

Cities have distinctive architectural and cultural qualities, strong forces of social inclusion and exceptional potential for economic development (Mumford, 1970). The Citadel of Erbil has always reflected the perceptions of an urban way of life and unique cultural and social features of living, as well as functional places of economic, historical and military activity and exchange. The citadel has played a significant role in the existence, the morphological and urban growth of the city. Moreover, the form and the height of the castle have shaped the urban pattern of the surrounding areas as concentric rings and a radial axis. In this sense, the citadel has always been the focal point of Erbil's urban development throughout its history (Figure 7.5).

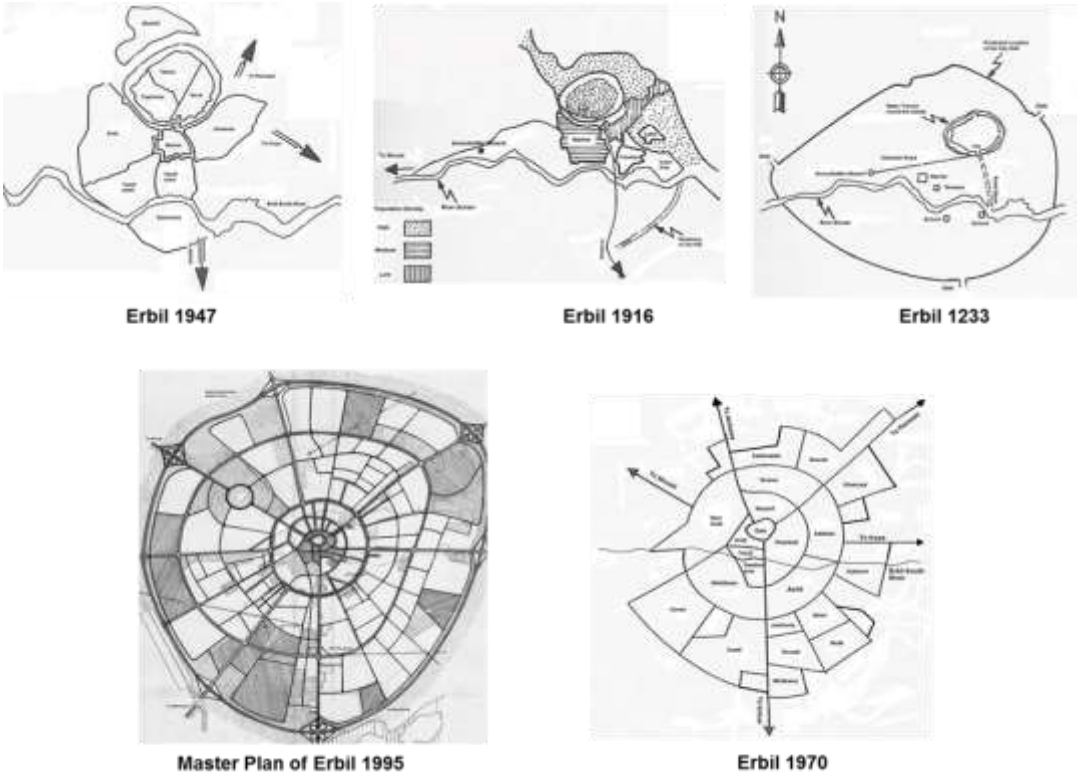


Figure 7.5: The Urban development of Erbil City, the Citadel is always considered the Focal Plot through the History (Erbil Municipality, 1995).

The historic city is no longer a "city in itself" as distinctive urban character enclosed within its walls. Rather, the archival documents have proved that the Citadel passed through four important spatial transformations. (Aljanabi, 1987), namely:

- The citadel city; all city interactive communication and living took place inside the walls.

- The citadel as a dominant urban quarter within a growing city.

- The citadel as a marker and focal point of authentic character that contrasts with the incremental modern urbanism of the new city, outside the walls.

- The citadel as a preserved historic quarter and artefact (Figure 7.6).

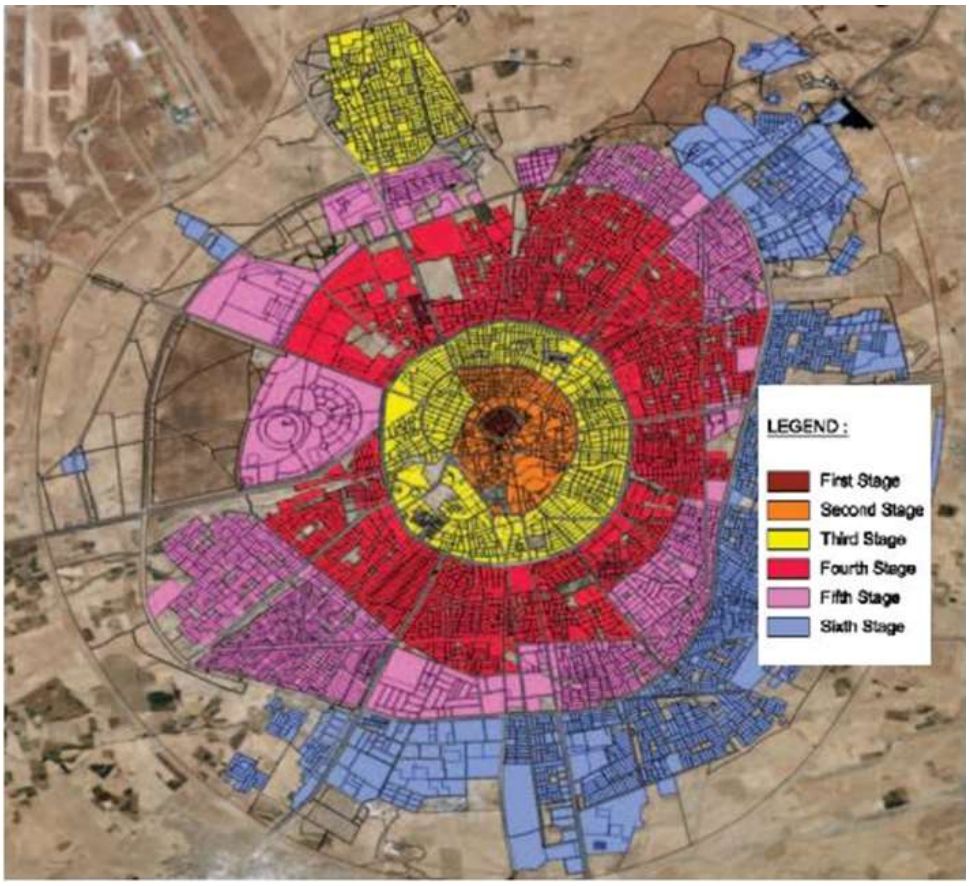


Figure 7.6: Urban Transformation Stages of Erbil City till 2007 (Dar Al-handasa, 2007)

Alhaidari (1985) indicates that the increasing population and emerging new land-use, the deterioration of the Citadel buildings, broad physical and functional decay, poor infrastructure, and the socio-economic transformation, have collectively encouraged the private sector developers and town planners to develop new quarters outside the Citadel. Alhashimi et al. (2015) highlights that three historic residential districts, Arab, Taajeel and Khanaqa developed outside the Citadel to the south, west and easterly direction. The types of houses in these old areas were characterised by cohesive urban fabric, social courtyards, and irregular street patterns which these were are similar to the citadel's pattern. Afterwards, Erbil has experienced a remarkable horizontal expansion. It has been growing in all directions due to its location on natural plains and where detailed plans of residential areas had been previously prepared. A large number of plots were distributed within the city, but lacked essential services and facilities and have therefore remained undeveloped.

The Kurdistan region does not, however, have its own regional constitution. Currently the KRG (2009) has legislative and executive authority in the areas defined by the Iraqi constitution, consisting of three provinces (Dohuk , Erbil and Sulaymaniyah), and its duties include allocating the regional budget, health, education and security. The administrative structure is highly differentiated into 5 administrative levels, including the KRG level, governorates, districts, sub-districts and villages (Table 7.1).

Erbil is now considered the region's most developed city and its strongest economy for several reasons; as the capital of Kurdistan Regional government, the Kurdish ministries, parliament, airport and the newly generated and expanded political infrastructure exist. Furthermore, the political and continual conflicts in the rest of Iraq have fostered belief in the Kurdish area, particularly Erbil, being the most secure and safest city of residence and job-seeking in Iraq. In March 2008, the International Organisation for Migration (IOM)

assessed that 2.7 million Iraqis had been displaced within Iraq during the preceding decade, and most of these people moved to Kurdish cities in the north. This naturally results in urban expansion dramatically (Khoshnaw, 2016).

Table 7.1: Local Administrative Municipalities of Kurdistan Region (KRG, 2009)

Governorates	No. of districts	No. of sub-districts	No. of Villages	Area Km^2
Erbil	10	37	1404	15074
Sulaimania	14	45	2526	21189
Dohuk	7	22	1170	11011
Total	**31**	**104**	**5090**	**47274**

7.6 City Planning

The appreciation of cumulative historic monuments is a central feature of urban planning practice and is of essential importance to the constitution of urban identity of any traditional city. Moreover, it transfers rational thoughts for place making and the built fabric of the city. Architecture and urban planning form a strong part of and play a major role in shaping the identity of historic cities (Kriken et al., 2010). With globalisation and acceleration in people's social and economic demands, the monotonous execution of traditional planning patterns cannot be a proper response to fulfil those needs. However, those patterns that have not experienced much change across history neither can they be adjusted and updated in line with the today's needs, but could be found and inserted in the modern city structures. As a result, an appropriate pattern could be anticipated for creating a sustainable city (Girardet, 2004). The relevance of a new urban reality and emerging characters to sustainable urban form has largely signified a lack of comprehensive vision for sustainable urban planning that connects with socio-spatial and cultural assets (Yildiz, 2004).

Urban planning is the responsibility of the Kurdistan Ministry of Municipalities, while planning and implementation of housing policies, strategies, and major housing projects are

the responsibility of the Ministry of Construction and Housing (KRG, 2009). Erbil is laid out in a pattern of concentric rings surrounding the old citadel in the city's centre. The distance from the centre to the outermost ring (120m Street) is approximately 5 miles (Figure 7.7).

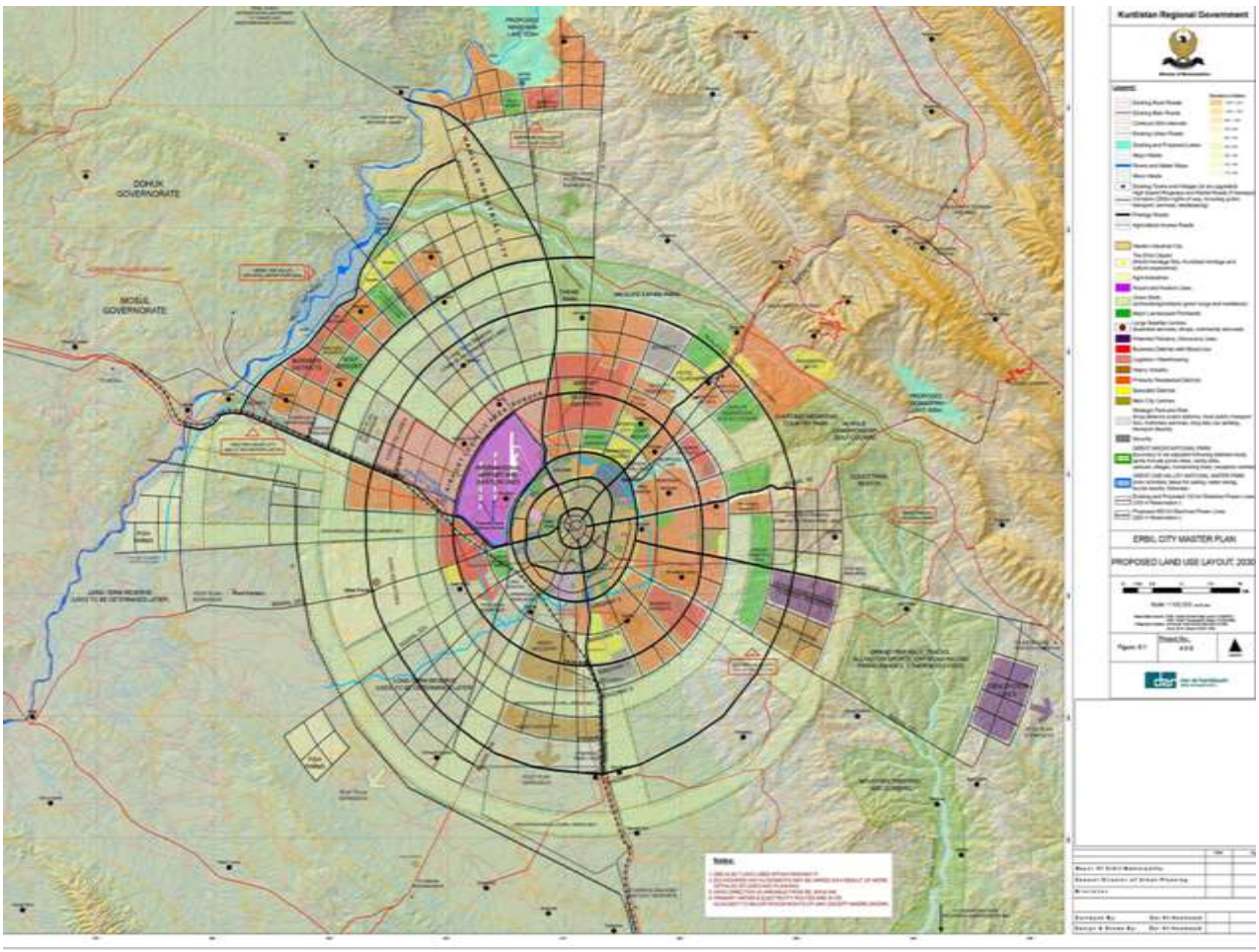


Figure 7.7: Erbil Recent Master Plan (KRG, Ministry of Planning, 2013)

Within the context of Southern Kurdistan, architecture is evidently closer to being thought of as a mere production of neoliberal policies and a result of the flow of foreign capital, however the debate on global versus cultural continues. The built environment, moreover, is considered the main factor in such confusions recorded in other parts of Kurdistan. It has become increasingly difficult to find a language for the reconstruction and the renewal process in the recent past. Actually, there has been a growing dissatisfaction with the recent built projects (Bornberg et al., 2006). Encapsulated in modernisation, the approach of a new built society, inclusive and

interpretive of neighbouring countries, can result in a new language for occupation that is a “deformation” of urban memories of Kurdistan. The most desirable way to secure an appropriate yet critical identity for Kurdish architects is to position oneself in the area of “cultural politics of difference” (Aziz, 2011).

7.7 Housing

Iraq has a rich tradition of housing design and construction. In recent years, the key housing producers – most of them public companies – have been unable to build enough housing to satisfy demand. To respond to the growing housing deficit, a comprehensive range of housing producers will have to be mobilised. Iraq’s housing needs are not only excessive, but also diverse. There is substantial demand for multi-story residential buildings and for low-rise and single-family housing (Iraq national housing policy, 2010). Due to the rapid growth in the urban areas, the city of Erbil is facing a large housing deficit: about 250,000 housing units are needed in 2016 (KRG, 2013). There is also a need to renew and redevelop most of the housings in rural areas because most of them have been built with non-permanent building materials and are below the acceptable level of housing standards.

The layout of housing in Kurdistan has transformed the face of major cities across the region. Rapid changes since 2003 have witnessed copious architectural structures and large housing projects that have reshaped the landscape of its cities (Figure 7.8). More than 90 Housing Projects in the region amounting to around $6.5 Billion, which is 42.9% of investment capital and 44.51% of investment land, have been distributed thus far making it the largest capital & land investment in any one sector in the region (Mumtaz, 2009). However, housing industry remains a critical issue in the Kurdistan Region due to the rapid growth and the migration of population

from rural to urban areas. Moreover, lack of rehabilitation and investment in the housing market and the escalation in rental prices has led to a shortage of affordable housing across the region. The abnormal growth and expansion of Erbil city in the second half of the 20th century, which was further augmented after the 2003 occupation, can be illustrated by the increased number of Erbil neighbourhoods. In 2012, eighty two neighbourhoods were counted compared to eight in the 1950s (KRG, 2013). This equal a 10-fold urban growth is around 60 years.

Figure 7.8: Urban Transformation, Old and New Residential Districts in Erbil City (R. Ibrahim)

Current housing projects have not been very successful, due to factors among which were unsupportive policies and investment by the government; irregular distances from employment opportunities and the lack of qualified local implementation companies which has resulted into an extra cost to the potential users. Moreover, the city is suffering from environmental degradation, and is facing a number of challenges including inadequate shelter; lack of access to educational and health facilities; inadequate municipal services and poorly maintained physical and environmental infrastructure. These problems are compounded by rapid spatial expansion and poor land management methods (Rassam och Dezayi, 2006).The character of the housing and local urban form needs a deciphering mechanism,

starting with hybrid historical architecture of huge civilization stories that mark a distinctive Kurdish place on the global map and thereby represent a characteristic identity for each entity (Ebraheem, 2013).

7.8 Urban Patterns and Sustainable urban form

According to chapter 5, the practical framework of urban patterns indicator has been successfully evaluated in two developed case studies. The application of this framework is considered a prerequisite demand in the historical city of Erbil. As seen in Erbil citadel and the traditional quarters that surround it. Strict urban planning and design regulations have contributed to the overwhelming constitutions of the notion of idealist city with well-connected, compatible, sustainable forms and cohesive structure (Figure 7.9). Some of these were articulation of religious principles of Islamic urbanism based on issues of cohesion, equality and proximity.

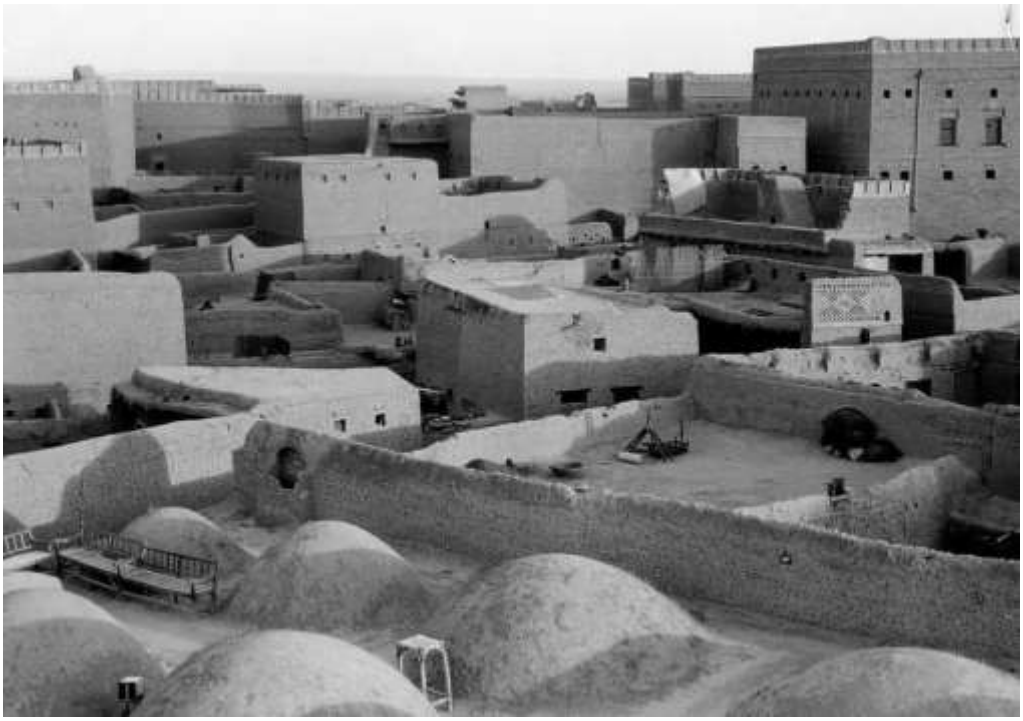


Figure 7.9: Citadel Cohesive structure 1930 (KRG, 2013)

However, in post war Iraq, the debate on the role of authentic values, identity and character of its architecture in shaping the future of the country's distinct built

environment has been a genuine contest on the aspiration for future. In the context of Erbil, historical fabric was never considered part of the city's sustainable future of government strategies which are mostly devoted to reinforce western visions and projects that materialise the new liberal economy and its capitalist agenda (Ibrahim et al., 2014). This inattention to the value of the local context have had major influences on the identity of the built environment of Kurdistan in general and its capital city Erbil in particular. Recent Erbil's built fabric has been transformed by the contemporary architecture, urban design trends and schemes. This involved creating or acquiring modern residential planning and incompatible urban patterns which are isolated from the surrounding quarters and eliminated the traditional characteristics of the city.

Basically, there has been a separation in the way in which urban planning approaches of the city are practiced and how the past, present, and future are connected. The recent residential projects in Erbil city indicate that in order to be sustainable, must be part of a larger evaluation process that not only tackles the constructed sites and buildings but also addresses the greater issue of turning uncompleted locations and the new development into fully functional and developed portions of the city (Yasin, 2011;, Jasim et al. 2013; Mzoori, 2014; Ali & Basil, 2015). Furthermore, municipalities and other executive institutions are increasingly required by communities to attach an intrinsic value to the culture and heritage on one hand and take responsibility for encouraging the application of appropriate practical frameworks which are compatible with local context and categorised within the sustainability settings on the other hand.

There is no doubt that change is inevitable. However, these attributes should simultaneously determine the role of sustainable frameworks in contributing to this

change. Accordingly, these development should be applied in ways that consider economic vitality, consider the public-good component of the city heritage, mostly its sociocultural values: the existence of buildings and public spaces of aesthetic, spiritual, social, historic, and symbolic value according to the needs of their inhabitants to be enjoyed by future generations (Akram et al., 2016). Nevertheless, there will be many limitations and obstacles regarding the application of such frameworks like: political situation in the region, economic support by the government, and the social values and traditions that required additional considerations (Alhashimi et al. 2015).

7.9 Transportation

Urban forms and transport have been identified as two fundamental aspects of sustainable cities by many scholars. The spatial arrangement of land-use is considered to provide as large an influence as the character of the transport system itself. How today's cities - and particularly the rapidly growing cities in the developing world - deal with the expanding demand for urban transportation will have a significant bearing on their economies, on the environment and, in large part, will determine the quality of life for their inhabitants (Suzuki et al., 2013). The transportation system in the Kurdistan Region is old, and hasn't been improved locally or internationally. In terms of infrastructure in Erbil City, the city lacks a fully mature and reliable public transportation network, though it has been presented as a competitive candidate to be awarded the Arabian Capital of Tourism for 2014. Unfortunately, there is a lack of a strict traffic system, modern buses, legible bus routes, bus stations and consistent schedules leaving many residents dependent entirely on the taxis and private vehicles. This has led to an increase in the number of taxis in Erbil (Figure 7.10).

Figure 7.10: Ordinary Heavy Traffic in the Centre of Erbil (R. Ibrahim)

According to recent statistics from the Erbil Traffic Police Directorate, more than 69,000 taxis are registered in Erbil. Those who cannot afford them buy cars. This contributed to busy traffic. Moreover, the rate of environmental and visual pollution has increased substantially (Jassim et al., 2013). However, there are reasonable bus services that run from the city centre to almost all of Erbil's neighbourhoods, but not between the peripheral districts (Table 7.2).

Table 7.2: Accumulated Erbil Vehicles Profile from Erbil Traffic Police

Type of Vehicle	2006	2007	2008	2009	2010	2011	2014
Private	29845	62034	98323	132309	183034	241907	352662
Taxi	6464	12163	18056	25739	35135	49036	69495
Trucks	5651	12086	24893	39173	64737	122902	149500
Motorcycles	1	474	4354	6504	8359	9549	10369
Agricultural	26	47	149	647	1097	1675	5602
Construction	164	206	623	1380	2074	3167	9372
Total No. Of Vehicles	42151	87010	146398	205752	294436	428236	597000

7.10 The Future of Erbil City

The City of Erbil has made extensive contributions to attain social, economic and political achievements on the global map since 2003. Within this context, this study attempts to identify the characteristics and main features of the city of Erbil. Post-war Iraq passed through an unstable socio-political condition following decades of oppression and undemocratic rule. Under authoritarian regimes, modernising the urban landscape through new planning schemes that imitate western models has largely dominated the top-down vision of changing the character of the traditional urban fabric in Erbil, similar to most Iraq's cities in the second half of the twentieth century.

In Erbil City, opinions about the castle and attachments to it vary considerably despite being the city's symbol for most people, especially older generations. As a source of controversy, rich history and stimulating future potential, the fortress (or Qala) has been confirmed as a logical point of focus for the identity of Erbil (Figure 7.11). The city is still confronted with master planning proposals, which are more based on the wishes of the national and local planning authorities and urban designers rather than the true needs of the city's residents.

The historic fabric of the city is under increasing pressure and regularly been invaded by the construction of new roads that undermine the structure of old residential and commercial quarters. Even in less problematic areas, new programmes of road networks are under way to satisfy marginal needs. Traditional cities safeguard and develop their historic urban areas and cultural heritage to make use of the potential of physical cultural heritage for the preservation of urban identity; not as a museum, but as a living, future-oriented organism adapting carefully to the

needs of people. It is important to adopt comprehensive approaches to urban planning such as city improvement strategies, strategic and action planning sustained by appropriate legislation and field control.

Figure 7.11: Erbil Citadel (Qala), the Sustainable Future of the City (R. Ibrahim)

It is necessary to engage a variety of stakeholders and community representatives in housing production due to the high demand to ensure diversity and compatibility. Residents of urban areas need multi-storey buildings that accommodate huge numbers of people and are usually built by large construction companies using significant capital investment. At the same time, there is a great demand for single family houses that can be implemented by a wider range of other investment and private companies. As a progressive step towards the future, the city of Erbil, leaders, government and people need to make positive changes to the natural and physical environment, its culture and the way it values the community. A set of

directions should be considered to realise this vision; comprehensiveness and engagement, improvement and business vitality and environmental responsibility.

7.10 Summary

This chapter is devoted to examine the urban development of the research context. It is a comprehensive and statistical study regarding the most important components related to the city of Erbil. The chapter highlights the significant role of the citadel (Qala) in shaping the future characteristics and features of the city. The housing sector is a central part of this chapter with all statistics and issues related to since the research is concern directly with this essential part. In addition, the chapter discusses the role of urban patterns framework and its application in the local context.

The next chapter 8 is the demonstration of the empirical results and the discussion of the analysed data which has been collected through the mixed research method.

Chapter 8: Results and Discussion

8.1 Introduction

This chapter displays all the results of the field survey to evaluate the current residential projects in Erbil City. Firstly, it illustrates the results from the questionnaire, interviews, and the fieldwork survey. Secondly, all data and graphs are analysed with the statistical package software known as SPSS and finally, a comprehensive discussion is presented to answer the research questions.

8.1 The Research Approach

Research to explore the impact of sustainable urban form has grown significantly over the past decade so many approaches and concepts have emerged. The previous chapters (2, 3, and 4) have presented a literature review and a theoretical context for this study. These have facilitated the formulation of the aim, objectives and issues of the research. Thus, this study has found that there is a real need for the development of systematic processes (methodological frameworks), consisting of a number of steps for exploring relevant indicators in the context of building arrangement, to assess and improve the local sustainable urban form.

The first part of this chapter presents quantitative results. The main purpose of quantitative analysis, which is in the form of a questionnaire and field work, is to answer the fifth question of the research which concerns how each indicator performs in the recent residential projects in Erbil city and evaluates the current residential projects The collected data (from a survey of 252 respondents) is processed for statistical analysis using the statistical package for the social sciences SPSS.

8.2 Questionnaire

In chapter 6, it was mentioned that the design of the questionnaire was based on the literature, and modified in response to the opinions of project advisors and experts in the field. The questions were divided into two sections, the first part focused on general information regarding the respondents while the second part concentrated on investigating the relationship between urban patterns and sustainable urban forms through a set of practical indicators.

8.2.1 General Characteristics of the Respondents

As mentioned before, the questions are divided into two sections. The first part includes generic demographic data related to the participants. This information was important to draw the conclusions through comparative analysis between the various demographic aspects. The profiling of the respondents allowed crossing tabulate and comparing the results to identify the perception and effect of each category. The analysis of data has adopted the type of residence and duration of stay as further variables. The analysis of these correlations has indicated a noticeable variation within each attribute compared to the other factors. The main objective was to enhance the reliability of the collected data regarding the performance of the indicators in each selected district.

The age of the respondents varies between 18-65 years. Most of the participants were male and middle aged people (Figure 8.1and 8.2). As per the results, these factors didn't indicate any variations or impact between the data. Furthermore, factor like number of household members indicate the average of families who resided the new districts (Figure 8.3).

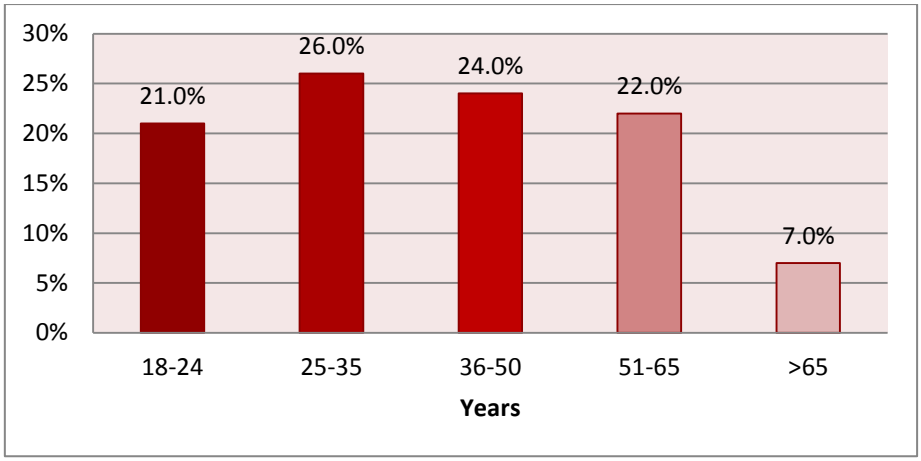


Figure 8.1: Ages of Respondents

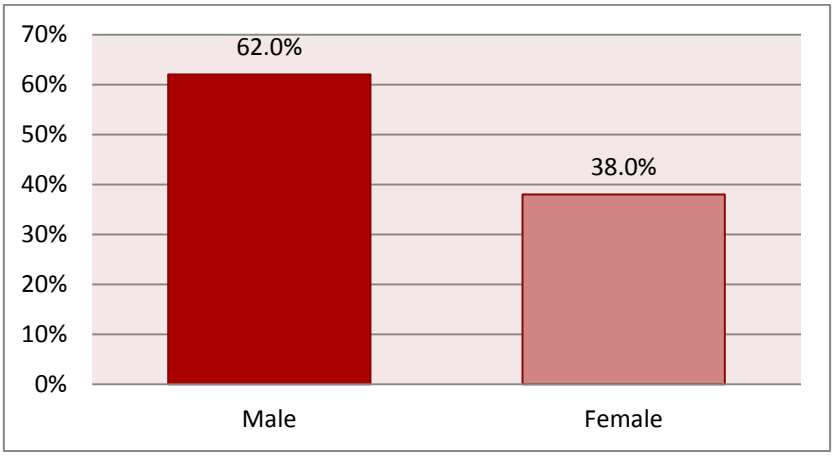


Figure 8.2: Gender of Respondents

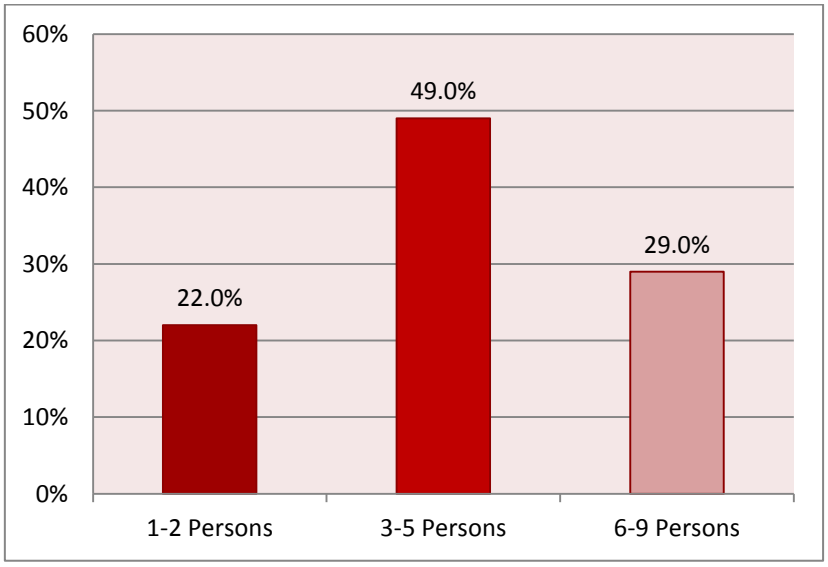
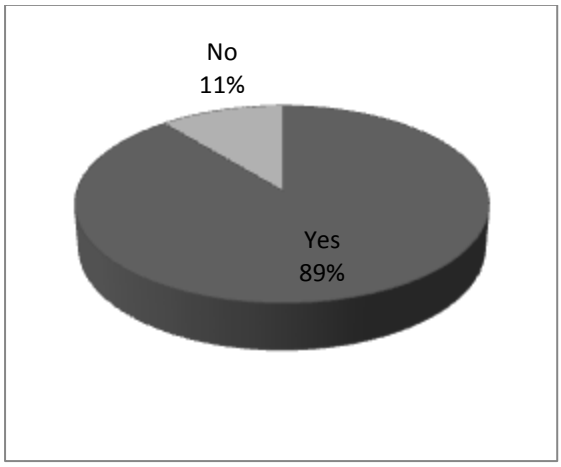


Figure 8.3: Number of Household Members

Finally, the results indicate remarkably the percentage of residents who owner private vehicles and the provision of cars parking (Figure 8.4 and 8.5). These results would raise an important question regarding the affordability and adequateness of the natural and physical built environment of the city.



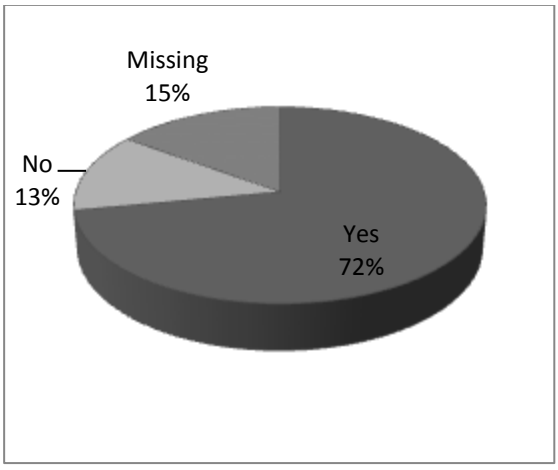


Figure 8.4: Private Car Ownership

Figure 8.5: Provision of Private Car Parking

8.2.2 Questionnaire and Qualitative Field Survey

This section essentially gives an overview of how people have evaluated their built environment. The sample was divided into two categories; the first group is the residents of the new residential projects, who constitute 55.5% of the overall selected samples (users). These people are considered very important as they have experienced the context of sustainability at first hand and are in a good position to explain how sustainable urban form indicators have been practised. In addition, these samples have reflected their attitudes and feedback concerning their current residence. The second group is a mixed sample, which has involved decision makers, planners, architects, scholars and academic students (experts). They are well equipped professionally to respond to the study appropriately since they are responsible for creating Erbil's built environment and they simultaneously occupy various local residential types. The third part of this section represents the qualitative

results conducted by the researcher. The main aim of the qualitative analysis is to explore and evaluate the performance of urban pattern indicators in the selected residential projects. Accordingly this assessment will provide reliable justification for the quantitative data on one hand, and justify the analyses and results that relate to the research questions on the other hand

Accessibility

Accessibility can be briefly defined as a measure of ease of access between different places or activities. These facilities have different needs and requirements, which are distinguished by the location, distance and mode of transportation. Many scholars have agreed that this factor is considered one of the important indicators which are used to compare between and evaluate different locations in the same region in the context of sustainable urban forms. Elements of accessibility in the questionnaire were divided into four questions depending on many factors like; ease of access, location of the dwelling, and provision of transportation.

According to the results, 64% of users of the recent residential projects had weak responses regarding the accessibility of the districts' facilities and blocks, and 73% of them were unsatisfied with the proximity of their dwellings to the public transportation. A young resident states 'the access to public transportation is very limited or sometimes non-existent. The quality of buses is low and needs great improvements. However, the price per one journey is acceptable'. Moreover, high percentages of users (46% and 40%) were moderately satisfied or dissatisfied with the accessibility to the open and green areas. However, there were good and moderate ranges of users who liked the accessibility to their building blocks, 22% and 47% respectively (Figure 8.6).

Regarding accessibility ranges submitted by the experts, there were positive values, an average of 22% who agreed that accessibility to the local services and facilities is well defined and they were more optimistic regarding the access to their buildings with an average percentage at 28%. However, the percentages related to the accessibility to public transportation and open spaces, registered lower rates at 55% and 23% (Figure 8.7).

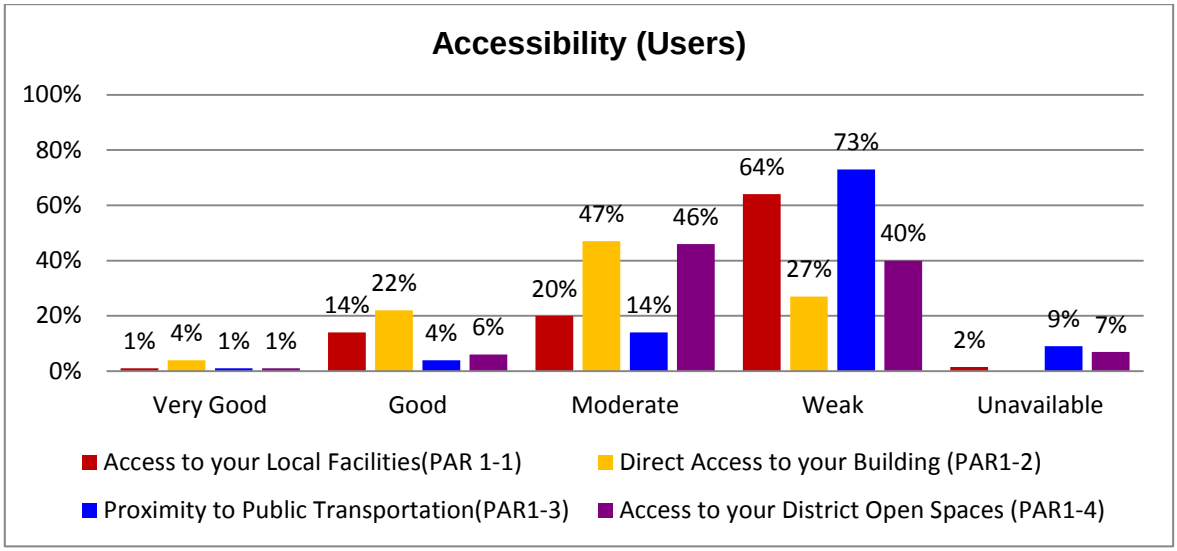


Figure 8.6: Users Assessment, Accessibility Percentages in the Residential Projects

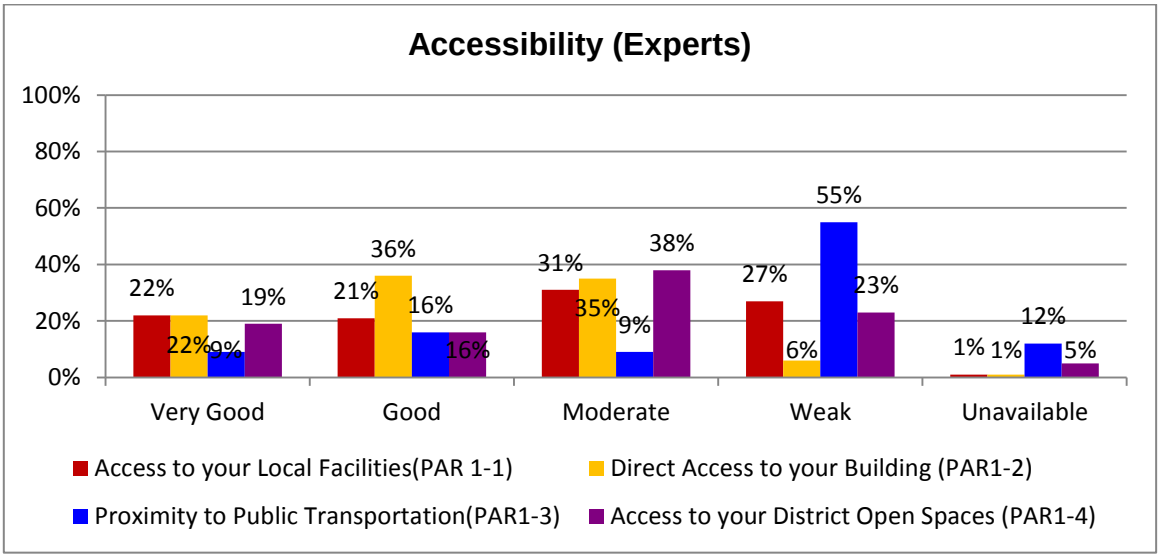


Figure 8.7: Experts assessment, Accessibility Percentages in the Residential Projects

The study has analysed then how accessibility varies compared to the type of residence, the data has clearly indicated significant results. Most of single-family

houses responded positively the access to local services with a percentage of 40%. However most of apartment and row-house residents were dissatisfied with the accessibility to local services with an average percentage at 20%.Furthermore, these residents were more unoptimistic regarding the access to public transportation with averages of 23% and 33% respectively (Appendix 2). Regarding Accessibility and duration of stay, the graphs have shown clearly that accessibility responses by both users and experts have significant variation concerning weak access to the local services and public transportation for users who have resided there between 2 and 4 years, with 25% and 32% respectively. On the other hand, both set of respondents confirmed the lack of appropriate pathways to the districts' open spaces. An old man replies "*It is important that the pathway to the dwelling is reasonably clear, level and obstruction-free. Old people and children need to be made aware of safe approaches to the location of buildings and entrances*". These results have percentages of 17% and 8% for users who have been living more than 2 years (Appendix 3).

The data collected by the researcher through the field work had almost correlative results. The results and measurements in Floria city have indicated high percentages regarding the accessibility to local and daily facilities and to the residential blocks at 55% and 45% respectively. However, access to public transportation remains undefined with a weak value at 42%. Regarding Ashti City 2, the field study results have shown that most of the accessibility indicators and elements registered dramatically unsatisfied levels. The access to local services and public transportation has registered weak averages at 45%. However, the access to the block's entrance has registered a better value at 40%. The relative results from the field observation and analysis of Park View district have indicated significant variation related to each

parameter of accessibility. Access to the location and the buildings and open spaces has registered a good level at 40%. While the access to local facilities and public transportation has registered very low levels with a weak average rate of 44%. In the Italian Village, the assessment of accessibility has also indicated significant variation and many valuable observations. The results showed a high degree of accessibility to the district's local facilities, the buildings and open spaces with an average rate of 37%. However, the access to public transportation has shown weak levels, at 30%. Finally, regarding the accessibility assessment in Cihan City the results show that there is noticeable variation in the indicator parameters. The accessibility of the local services and public transportation has shown dissatisfied and weak rates, at 51% and 40% respectively. However, the access to the towers and open spaces has registered better levels with an average rate of 40%. Generally, the averages have indicated increased rates regarding access to the blocks and local services and decreased percentages regarding access to public transportation and public spaces (Figure 8.8). In addition, the urban pattern in these local projects had a noticeable impact on the parameters' performances which was related to accessibility.

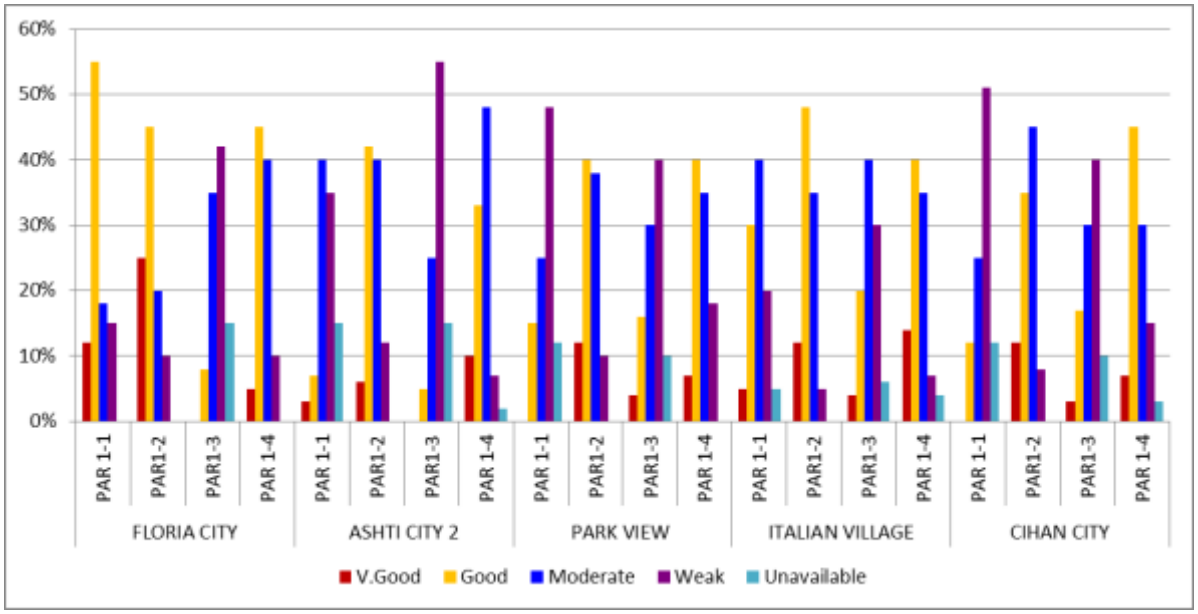


Figure 8.8: Qualitative Assessment of Accessibility in the Local Projects

Connectivity

It is obvious that understanding, measuring and analysing the dimensions of sustainable urban forms holistically is an intricate issue. Many factors should be thoroughly studied and inspected, like the context of the district and its background to achieve appropriate urban forms that promote sustainability. Connectivity means briefly the proximity, continuity and contiguity of the built environment which may result in higher social interaction, secure places and integrated quality of life. The connectivity within district blocks on one hand and between other close neighbourhoods on the other hand, is an essential dimension of sustainable urban form which is widely accepted and practiced. The questionnaire has focused on these two significant themes to gain respondents' related attitudes.

For users of the recent residential projects, the results indicated that the majority of respondents were relatively satisfied regarding the connectivity between their buildings and the other blocks in the same neighbourhoods at 57%. However, the new district residents have shown their clear dissatisfaction with the planning methods of connection with other adjacent neighbourhoods at 76% since their districts are bordered by high fences (Figure 8.9). Nevertheless, a few residents have shown their agreement regarding the current security procedure in their neighbourhoods. An old woman who resides in the Italian village states "*People feel safe and secure here. We avoid social contact with other adjacent neighbourhoods*".

Regarding connectivity responses submitted by the experts, there were more parameters to be assessed. The answers were more optimistic and positive. The assessment as shown in Figure 8.10 reveals how the answers were almost equal regarding the four parameters. More than 33% think that the connectivity of the new districts is good or moderate. However, the connectivity with the adjacent

neighbourhoods still showed lower rates of satisfaction with an average rate of 55%. Moreover, there were a few respondents who believe that the availability of col-de-sacs in the districts is acceptable with the appropriate rate at 31% though it is an indication of inadequate connectivity.

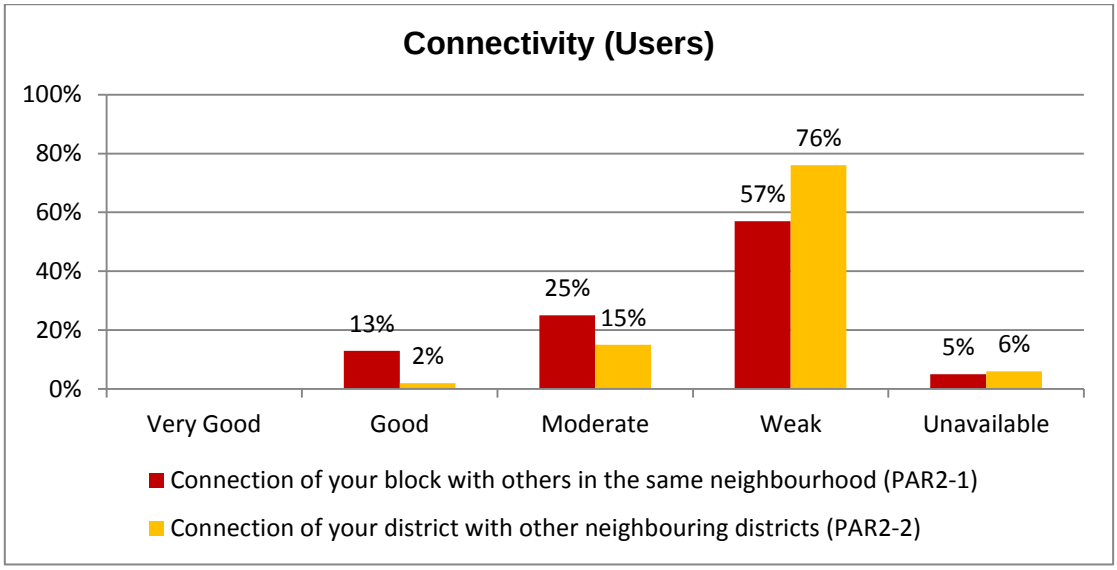


Figure 8.9: Users Assessment, Connectivity Percentages in the Residential Projects

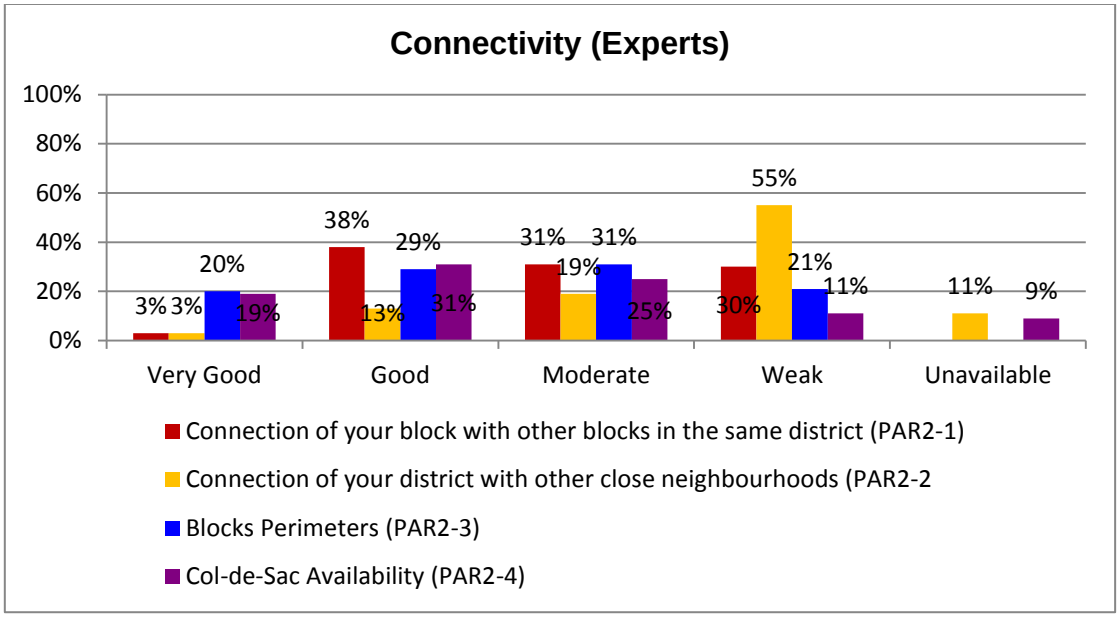


Figure 8.10: Experts Assessment, Connectivity Percentages in Residential Projects

The relationship between type of residence and connectivity has indicated weakness in the internal connectivity of the apartments and the row-house residents with averages percentages at 13% and 22 % respectively. Furthermore, most of the residents expressed their negative perceptions towards the connectivity with other districts and registered the highest among row house residents at 27% (Appendix 2). The results regarding connectivity and the duration of residence have shown significant variation regarding respondents who have been living in the area more than one year. More than 27% of users who have resided there between 2-4 years were dissatisfied with the connectivity of their districts with close districts. However, there were moderate opinions regarding the internal connectivity for users who have resided there more than one year with an average rate of 13% (Appendix 3).

The researcher has collected the relative data regarding connectivity parameters through site survey. The results and measurements in Floria city have indicated a high percentage (48%) of internal connectivity due to the well-defined building blocks and the hierarchy of the internal streets and moderate percentages regarding block perimeter and col-de-sac availability with an average rate of 35%. However, connectivity between this community and other adjacent neighbourhoods has shown weak levels with a percentage rate of 58%. Regarding Ashti City 2 district, the internal connectivity has registered high percentages at 44%, whereas block perimeter, street hierarchy and the connectivity with adjacent neighbourhoods have scored lower levels with percentage rates at 45% and 52% respectively. In the Park View project, the internal connectivity and building parameters have indicated good percentages at 55% and 58% respectively. However, the hierarchy of streets and connectivity with close neighbourhoods were still inappropriately defined at weak levels, with an average 46%. The percentages in the Italian Village were extremely

different. The internal connectivity and the integration with adjacent districts have indicated weak levels with an average percentage at 55% due to the large span of residential blocks and the unreasonable number of cul-de-sacs. However, internal street hierarchy has registered a better level at 40%. In Cihan City, the connectivity has also indicated variation in the parameters. There were good levels of internal connection, small block perimeters and appropriate street hierarchy with an average percentage at 45%. However, the connection with the nearby neighbourhoods has shown undefined aspects like high protective walls and unclear external pathways with a weak percentage of 58% (Figure 8.11).

In general, most of the recent residential projects lack the connectivity and integration with the neighbouring districts, providing instead more secure and private communities. In addition, increasing the number of cul-de-sacs would weaken the internal connectivity. However, the other parameters have indicated different rates depending on the planning scheme and the urban pattern of the district.

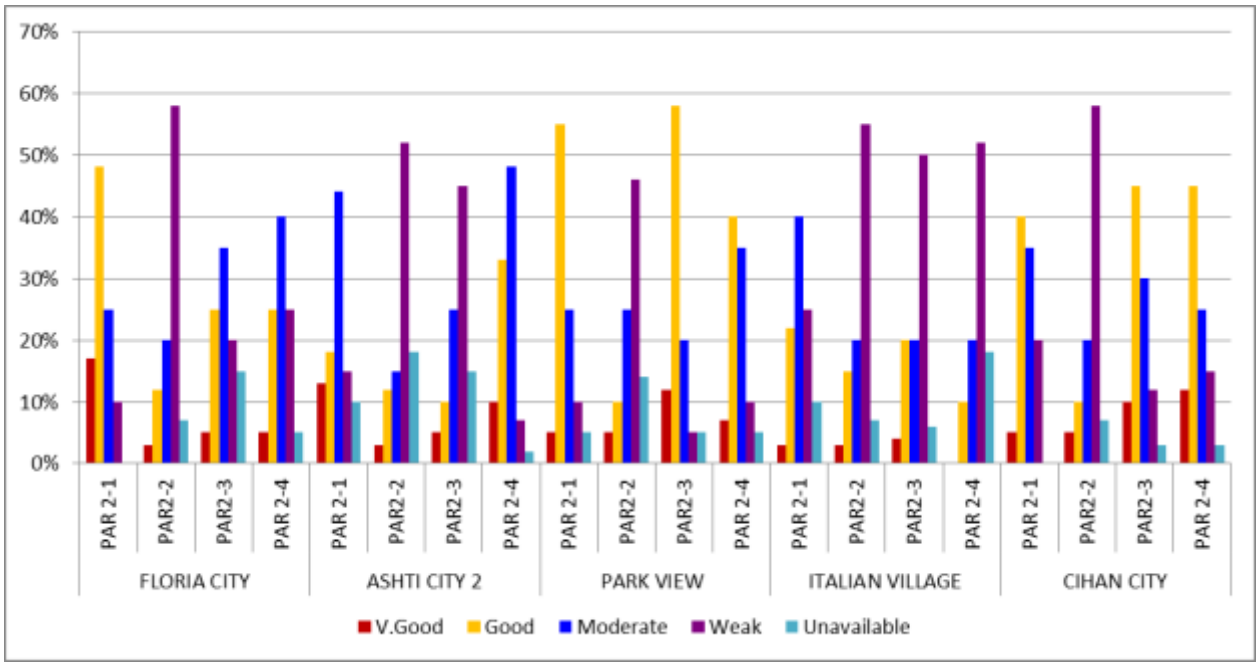


Figure 8.11: Qualitative Assessment of Connectivity Percentages in the Local Projects

Compatibility

This indicator is considered an essential component of sustainable urban places and increases the quality of urban layout in the context of sustainability. Achieving compatibility between spaces and places means maintaining an appropriate level of unity, harmony, balance and taking into consideration the aesthetic value of each compound urban configuration. The questionnaire has concentrated on one specific question regarding this indicator since it requires experts and related professions to answer and fulfil its holistic requirements. The question asked the respondents to evaluate their dwellings' compatibility and harmony with their surroundings.

Regarding users of the recent residential projects, almost half of the respondents (45%) agreed that their current built environment is incompatible and there is a weak relationship between their buildings and the surroundings. However, there were other users (42%) who evaluated their built environment compatibility as moderate (figure 8.12).

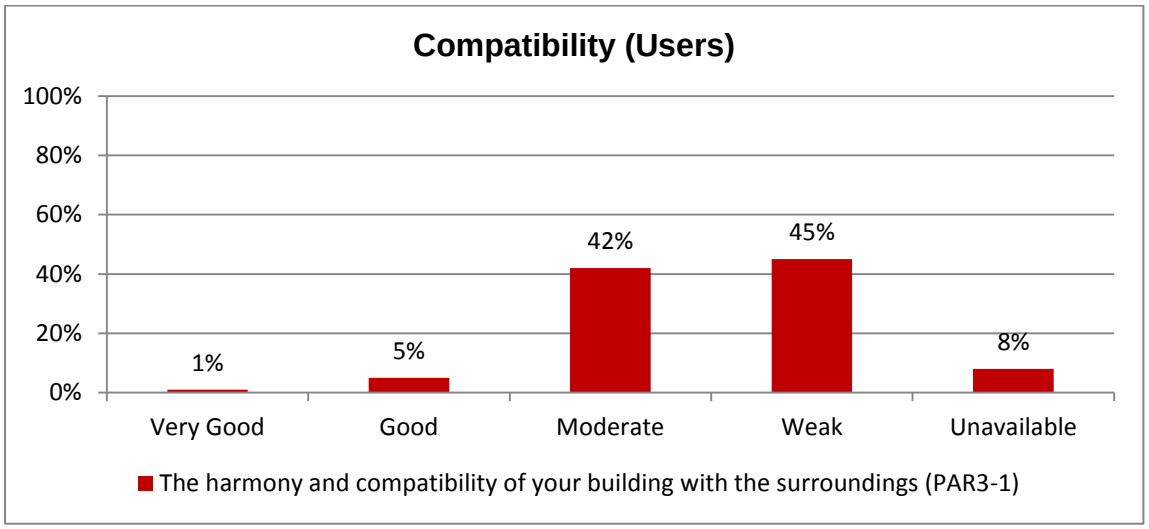


Figure 8.12: Users Assessment, Compatibility Percentages in the residential projects

Experts responses related to compatibility parameters were noticeably similar to the users regarding the above mentioned indicator. Almost half of the experts (43%)

agreed on the weakness of harmony and compatibility in these districts. Moreover, (36%) have shown dissatisfaction regarding the richness and the stability of their built environment. However, there were very good and good assessments (18% and 31%) regarding the legibility and imageability of their buildings. Moreover, opinions regarding the unity of the buildings were moderate with an average percentage at 38% (Figure 8.13).

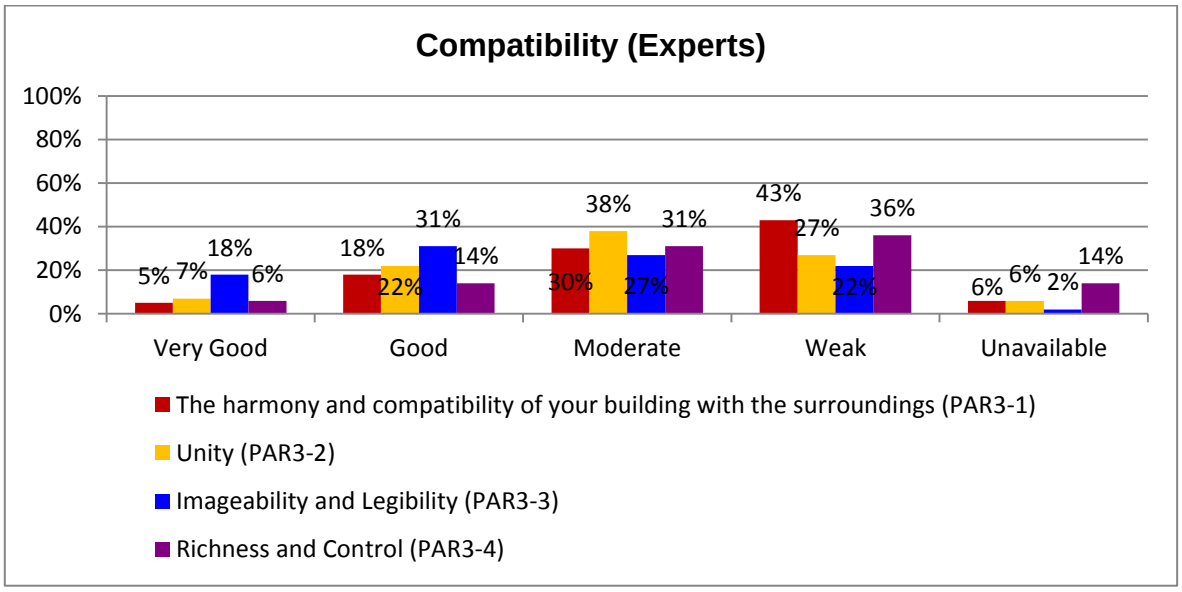


Figure 8.13: Experts Assessment, Compatibility Percentages in the residential projects

Regarding the factor of type of residence, the result has shown optimistic averages at 24% by the row-house residents. However, the single-family residents were dissatisfied with harmony and compatibility of building and the surroundings. The results indicated an average percentage of 20% (Appendix 2). The results regarding the relationship between compatibility and the duration of residence, the results have indicated similar averages to the users' and experts' responses. Respondents who have been living more than 1 year in the district have shown their dissatisfaction regarding the compatibility of their built environment with an average rate at 15%. However, there were a few respondents (9%) who believe that there is a good

relationship between their buildings and the surrounding (Appendix 3). One of the old residents highlights that: "*I think there a good relationship between the buildings here, the heights, materials, and the styles. I have been living in this house for more than five years, I am glad to live here*".

Finally, the researcher performed site analysis for the five selected projects regarding the compatibility of these built environments. In Floria City, the results have indicated high percentages (53% and 45%) regarding the imageability of the buildings and the unity of their elements. However, parameters like the harmony and richness have shown moderate percentages at 40% and 42% respectively. Compatibility parameters in Ashti City 2 have indicated different aspects. The legibility, unity and richness in this project are inadequately defined with an average percentage of 40%. However, the harmony of the dwellings related to the surroundings has registered a better rate at 45%. In Park View high-rise district, the compatibility and harmony of the project has registered a weak rate of 40%. Moreover, the unity and stability of the buildings have scored moderate levels with an average percentage of 48%. However, parameters like imageability and legibility of the mass have indicated good rates at 52%. The harmony in the Italian village has indicated a moderate rate at 35% while the unity and stability of the project have registered lower rates at 40% and 38% respectively. However, the legibility of the project indicated a weak rate at 52% due to the high surrounding wall. In Cihan City, the imageability and legibility of the project has indicated a very good rate at 55% while, the unity and stability have registered moderate levels at 42%. However, the harmony and the richness of the project had the lowest rate at 40%.

In general the compatibility and harmony have shown weak performances, while parameters like imageability and legibility indicate good percentages in the high-rise projects (Figure 8.14).

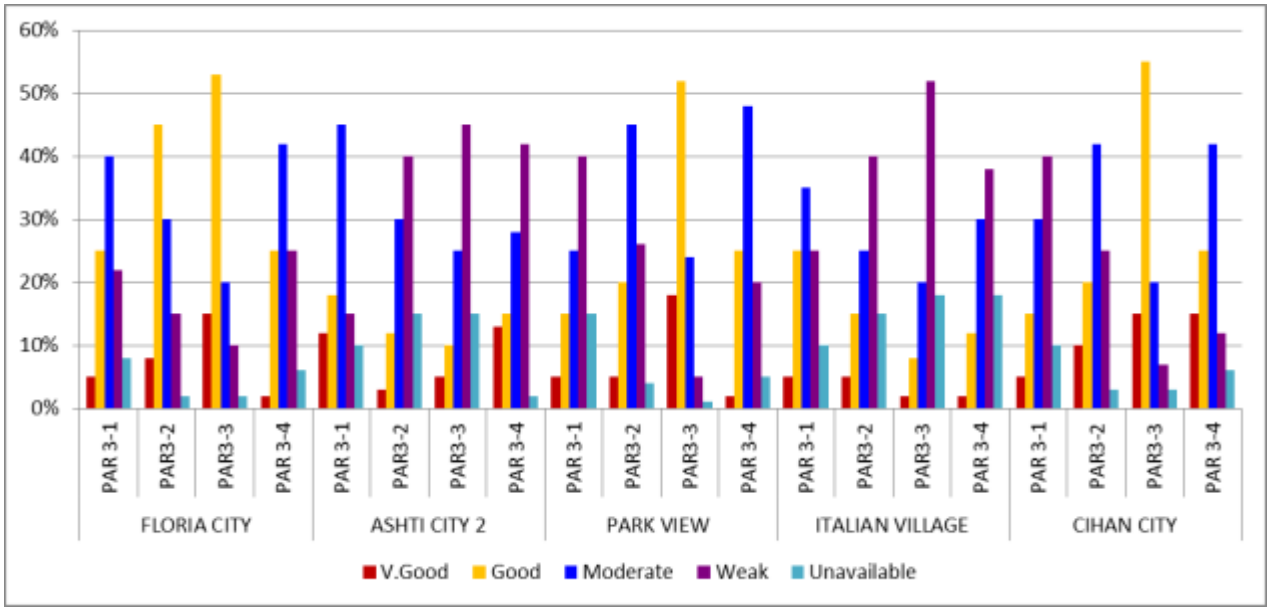


Figure 8.14: Qualitative Assessment of Compatibility in the Local Projects

Diversity

Sustainable urban form is defined to the degree that supports land use diversity which may maintain economic vitality, social interaction and neighbourhood liveability. The provision of daily needs in each district is one of the important elements to encourage walkability, liveability and social exchange. The questionnaire included three significant questions which are related to this indicator: the availability of mixed-housing types, how to evaluate land use variation and vitality, and the vibrancy of visitors and local residents near these facilities in the recent neighbourhoods of the city.

Most of the users of the new residential districts (62 %) were relatively satisfied with the facilities and services provided in their quarters (Figure 8.15). However, during

the collection of the questionnaire, there were a few respondents who expressed their dissatisfaction regarding this indicator. An adult mother states "*Many services are unavailable, like a health centre and post office, besides the high price of daily needs, so we are forced to drive to the nearest affordable shopping centres*". This is due to the lack of competitive markets which provide important day-to-day services and facilities. Meanwhile, a young resident adds "*Here, most of the residents prefer staying at home after 8 p.m., there are no entertainment facilities or nearby café. We have asked the relevant authority for help, but there is no response*".

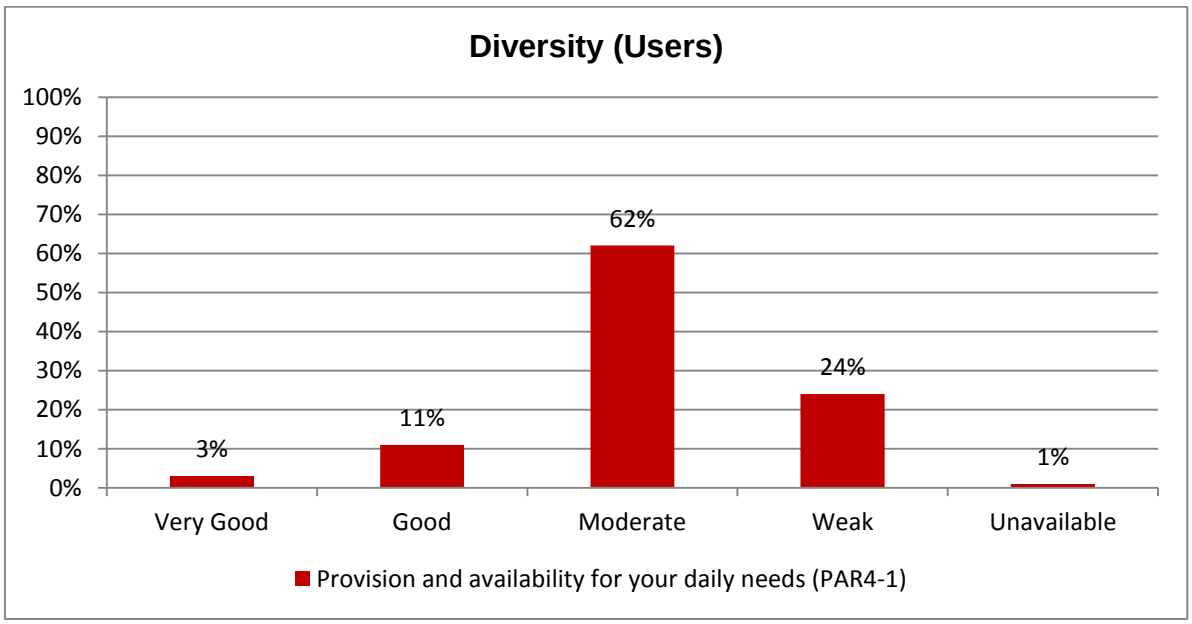


Figure 8.15: Users Assessment, Diversity Percentages in the residential projects

The results submitted by the experts were similar to the user's responses. Most of experts agreed that the provision of local facilities for daily use is basically moderate at 36%, while the others were divided between good and weak at 20% and 26% respectively. However, there were many who are dissatisfied with the vitality and the vibrancy of people in their districts with rates at 39% and 33% (Figure 8. 16). Nevertheless, there were a few who still assess their districts positively regarding the provision of need and the liveability for residents.

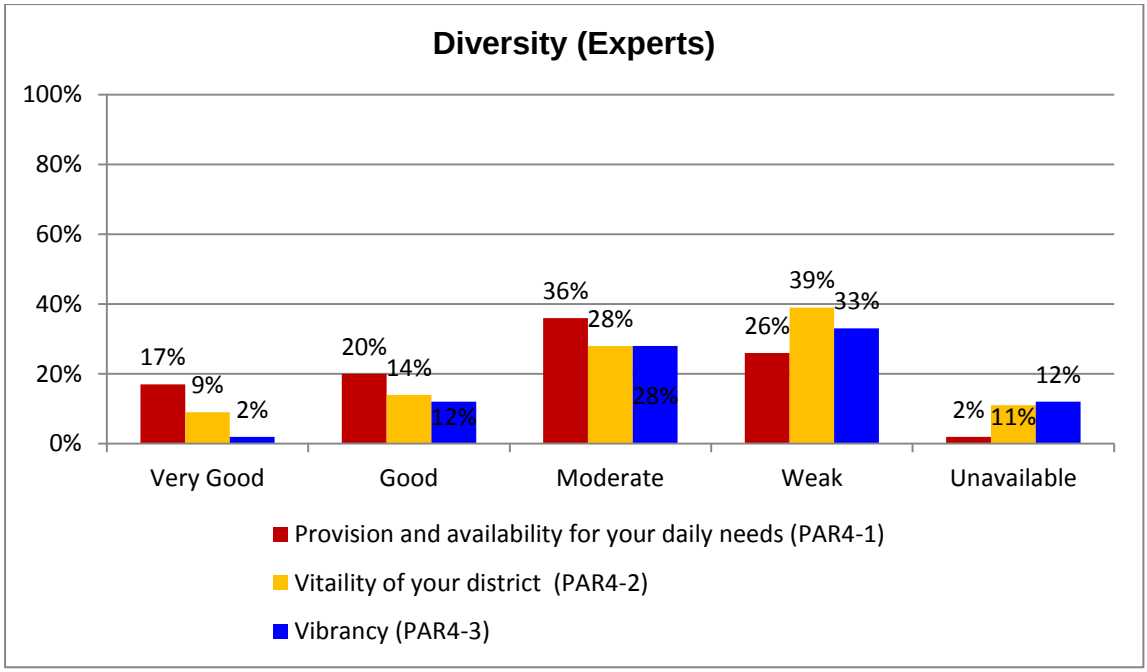


Figure 8.16: Experts Assessment, Diversity Percentages in the residential projects

The provision of daily uses within row-house residences indicated good averages at 12% and moderate at 25%. However, the result within the apartments' area has shown weak percentages at 18 % (Appendix 2). The duration of residence results has indicated similar responses for respondents who have been living for more than 2 years in their districts. Most of the residents have assessed the provision of daily facilities moderately at 36%. However there were 10% of residents who have been started living there recently and were satisfied with the current services provided (Appendix 3).

Regarding the field survey which concentrated on the performance of diversity in the recent residential projects, the results have shown similar indications. In Floria City, there were several daily facilities missing like a secondary school, health centre and post office with a moderate rate of 43%. However, it was unreasonable to analyse the liveability in the project since it is still under-construction. The data in Ashti City 2 reflects weak provision of daily and entertainment facilities in the project with the percentage at 40%. Moreover, the lack of attraction facilities has caused weakness

of vitality and vibrancy in the project at 48%. One of the important aspects in the Park View project is the provision of attractive facilities and entertainment services to appeal as much to residents as to visitors of the project with rate at 51%. However, there were many missing daily services which are considered very important to the project like schools and health centres with a rate of 35%. In the Italian Village, the provision of daily uses needs complete addition of services, entertainment and social places. The averages have indicated moderate percentages compared to the previous project at 44%. However, the vitality and vibrancy of the project shows lower averages at 40%. Finally, in Cihan City, the provision of daily uses and their locations need reconsideration compared to the project size and daily requirements with a lower rate of 52%. However, the vibrancy and liveability of the project were avoided since the project is under construction (Figure 8.17).

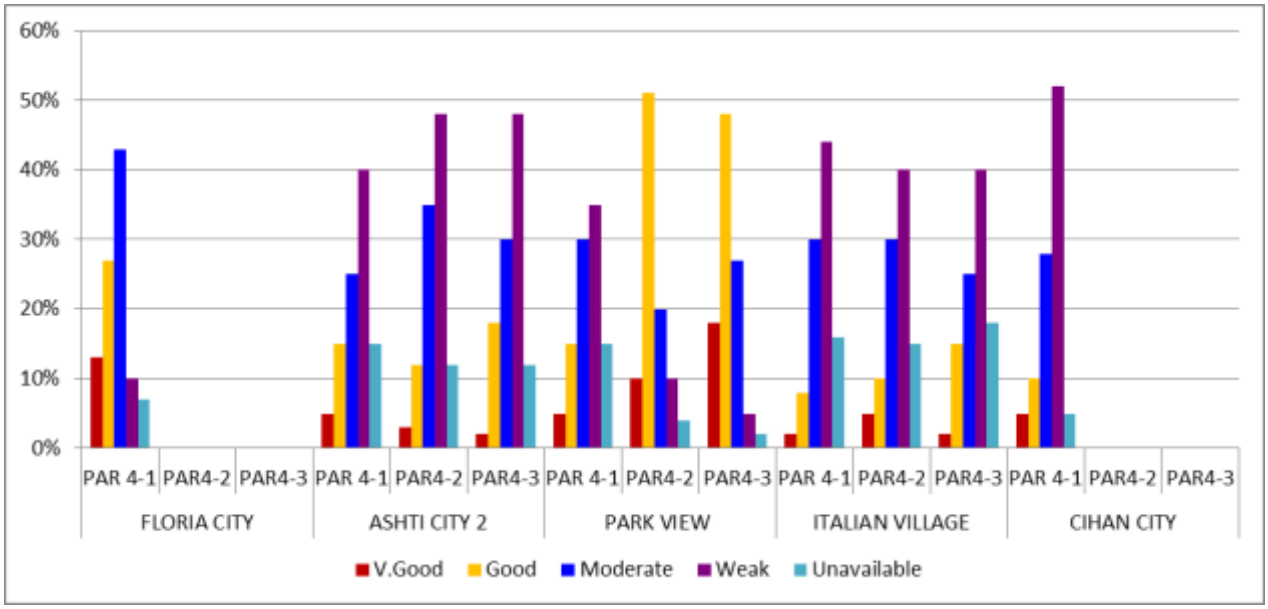


Figure 8.17: Qualitative Assessment of Diversity in the Local Projects

In general the provision of local daily facilities is considered in the most recent projects but it still lacks completion since there are many unavailable important

facilities and entertainment activities. The vitality and vibrancy percentages vary according to the provision of local facilities, daily uses and entertainment places.

Nodality and Containment

Sustainable urban nodes mean creating positive and liveable spaces through the proper clustering and organising of several buildings and urban blocks. As mentioned in chapter five, the character and the sense of enclosure in these spaces can vary by the environment, culture and quality of the design. Therefore, achieving sustainable urban forms and regenerating creative open spaces within are two significant and interrelated approaches which are encouraged by many scholars and planners. The questionnaire has discussed three different elements of liveable urban nodes. The first question was related to the appropriateness and comfort of the open spaces in the districts, the second question assessed the quality of the walking environments and the third question evaluated the social exchange and interaction of these areas.

Users of the recent residential projects inclined to the weakness of this indicator in general. 52% have responded negatively to the availability of adequate green areas and open spaces. In addition, more than 58% assessed the walkable environment as an unsatisfying element in their areas. The users were divided between supporters (35%) for the social interaction in their district (almost inhabitants of the low-rise projects). "*It is the place where we continue our social interaction and engagement activities with our neighbours and my children feel safe and secure to play here*", claims a middle-aged mother. However, more than 37% were dissatisfied with the social relationships in their neighbourhoods (Figure 8.18).

The expert's responses have shown more optimistic values related to this indicator. The percentages regarding the provision of adequate open spaces were divided between 29% who were satisfied and 32% who feel the opposite. The protection of walkable environment and social interaction continue with the similar percentages to the previous responses with weak average of 34%. However, there were a few respondents (13%) who still believe that the recent projects have provided appropriate places for social interaction (Figure 8.18). An old resident says "*It is not merely a space for transportation or passing by, but one for work, commerce, play, visit, gathering ceremonies, festivals and other social events, besides, our neighbourhood's collective and intimate memories*".

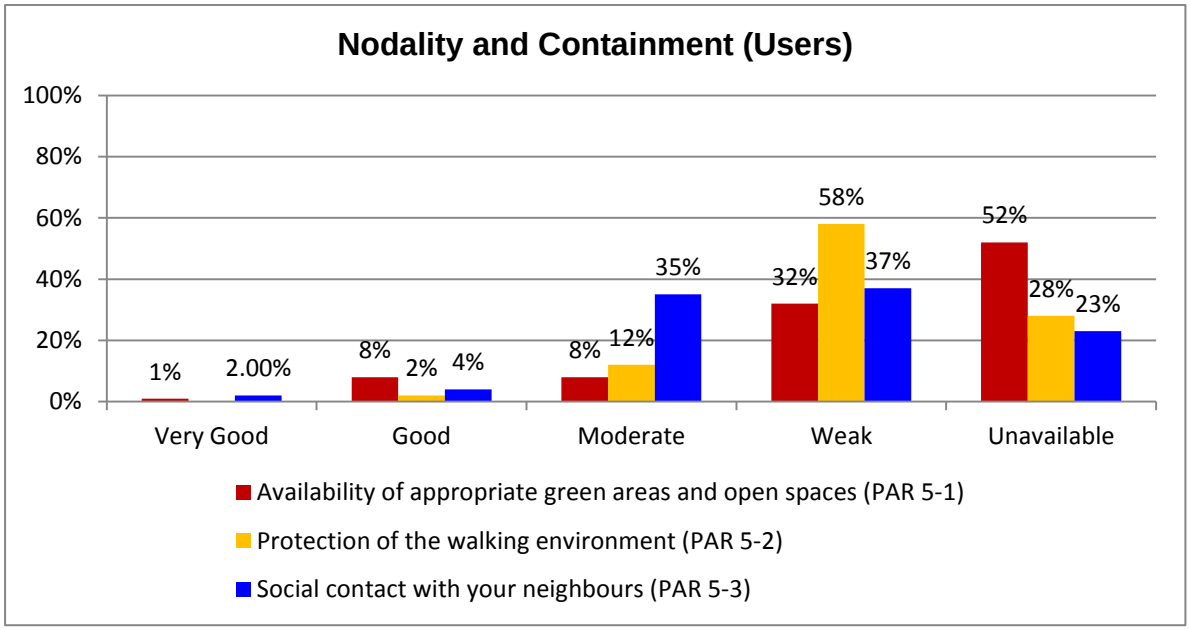


Figure 8.18: Users Assessment, Nodality Percentages in the Residential Projects

Responses regarding scale and proportion were sometimes thought to be weak (37%) or believed to be good (28%) depending on the arrangement of buildings in the project (Figure 8.19). Finally, the results regarding the provision of social privacy were divided equally according to the building types. The respondents were satisfied and assessed this factor positively when they resided in low-rise or single family

dwellings at an average of 21%. However, most of apartment residents have assessed this aspect weakly with an average of23%. Accordingly, the organisation of urban pattern and the diversity of building type have played a major role in the responses.

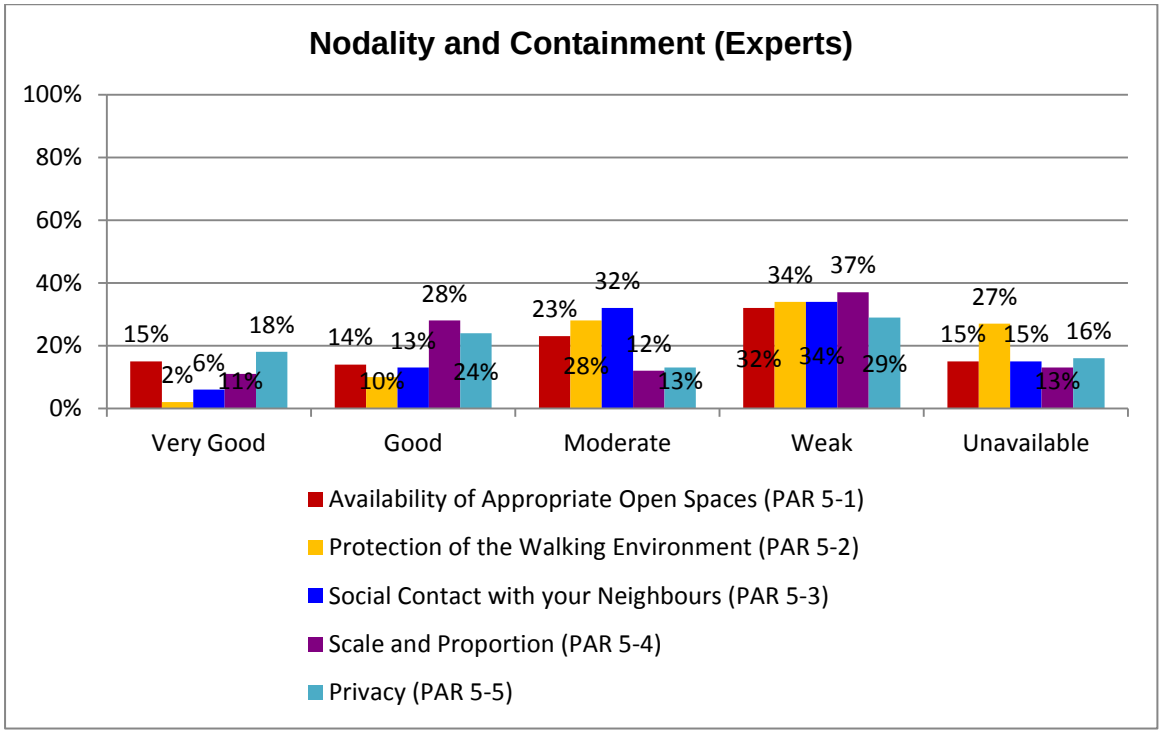


Figure 8.19: Experts Assessment, Nodality Percentages in the Residential Projects

The results regarding the relationship between this indicator and the type of residence indicated significant variation. The provision of appropriate open spaces registered good levels within the apartments and the single-family houses with percentages of 22% and 18% respectively. However, the social interaction among the families was very disappointing within the first area at 24% and at moderate percentages within the single-family residences at 32% (Appendix 2). In terms of the duration of residence, the results have shown little difference compared to the previous responses (Appendix 3). Most people who have been living in their districts

more than one year were dissatisfied with availability of open space (32%), the protection of the walking environment (36%), and with the social interaction (20%). A new resident adds "*We moved here recently and actually enjoy our time; the neighbours are very kind and helpful*".

Field survey regarding the evaluation of nodality and containment has been conducted in the recent projects (Figure 8.20). In Floria city, there were good percentages regarding the availability of open spaces containment, human scale, and the provision of appropriate private spaces with an average percentage of 48%. However, the protection of the walkable environment has registered lower percentages at 45%. In Ashti City 2, nodality performance scored weak percentages regarding appropriate open spaces, and pedestrian pathways 42% and 53% respectively. The social interaction has a moderate percentage at 45%. However, the provision of privacy and human scale has registered a better level with an average percentage of 40%. The results in Park View were extremely different. The provision of good open spaces and a walkable environment has registered a good level at 40%. However, the social interaction, human scale and privacy have scored very weak percentages at 54%, 60%, and 58% respectively. In Italian Village, social interaction, human scale and privacy have scored good percentages with an average at 45%. However, inadequate open spaces and the lack of walkability protection registered very weak percentages at 53% and 56%. Finally, in Cihan City the provision of open spaces registered moderate levels at 40%. However, inappropriate pathways, the lack of human scale and privacy are the main weak aspects with a weak percentage of 52%.

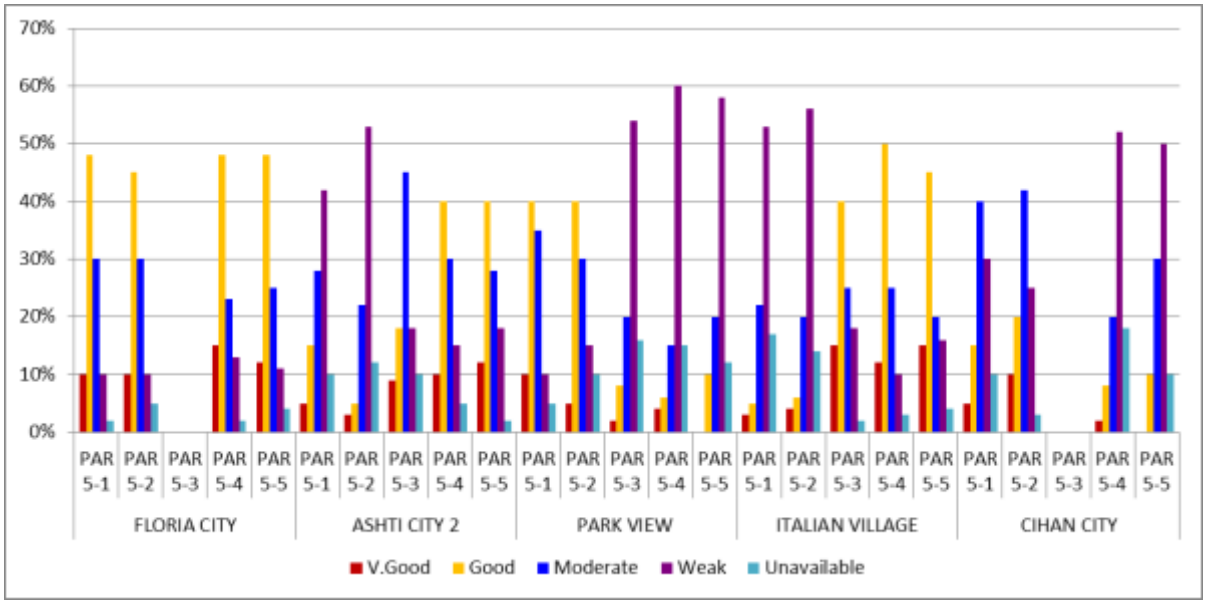


Figure 8.20: Qualitative Assessment of Urban Nodality in the Local Projects

In general the performance of urban nodality and containment in the recent projects is inadequate regarding the landscape design and the provision of appropriate social interaction places. However, the indicators of human scale, building proportion and privacy fluctuated depending on the urban patterns and the type of residence.

Density

Density means briefly the number of dwellings or people in a determined area. Many scholars have agreed that in the developing countries with rapid population growth, the need for density and less land consumption will likely lead to more sustainable urban communities especially in the environmental and economic contexts (Jenk and Jones, 2010). Density doesn't mean affording only compact high-rise towers in a small area, but effectively providing variation in housing types as well. The questionnaire asked the respondents to evaluate the urban grain in their neighbourhoods in the sense of the distance between the blocks, size of open spaces and population density. The researcher knew that this question would be difficult for many unspecialised applicants. However, remarkable notes and results have been indicated.

Most of the users (42%) in the new districts have evaluated their urban density moderately. In addition, (10%) of the residents were satisfied with compactness and the type of dwellings (Figure 8.21). A middle-aged resident highlights that "*I chose this type of dwelling because of its location near my work-place, the available modern services, and the nice view provided"*. However, many other residents (24%) were dissatisfied with the compactness of their residence and with this type of dwelling. "*I dislike living in apartments since you do not have private space and a garden, besides, there is the disturbance from other neighbours who have many children*" replies a retired scholar who had lived all his life in a low rise dwelling. As mentioned before, the evaluation of this indicator remains critical since it is more related to calculations and expert respondents.

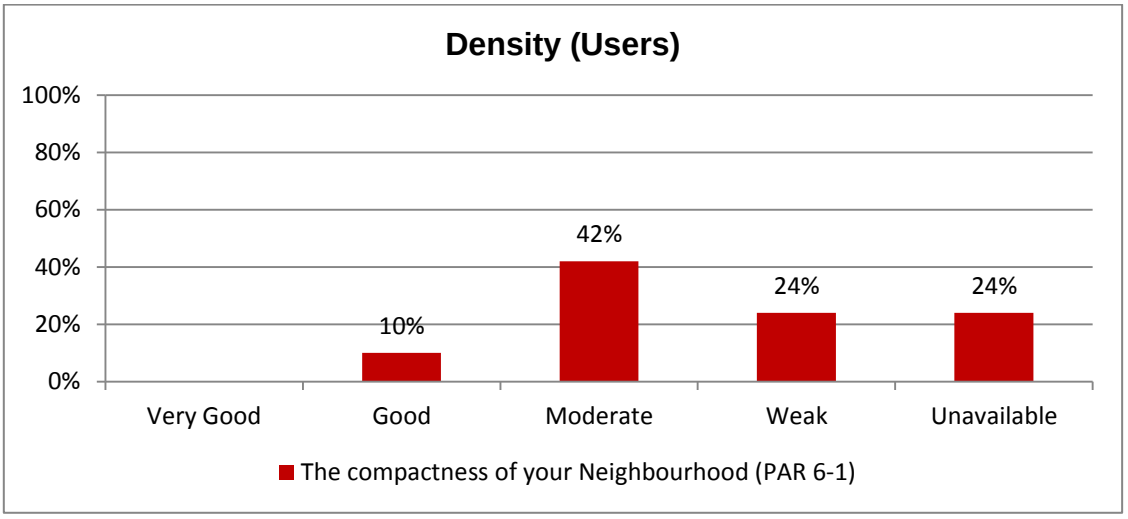


Figure 8.21: Users Assessment, Density Percentages in the Residential Projects

Experts have responded similarly regarding the compactness of the current built environment. (39%) of the experts have assessed the density of their districts weakly. However, population density has registered better scores at 31%. Regarding the contiguity of the blocks, the majority of the respondents inclined towards the weakness of the current built environment with an average rate of 30% (Figure 8.22).

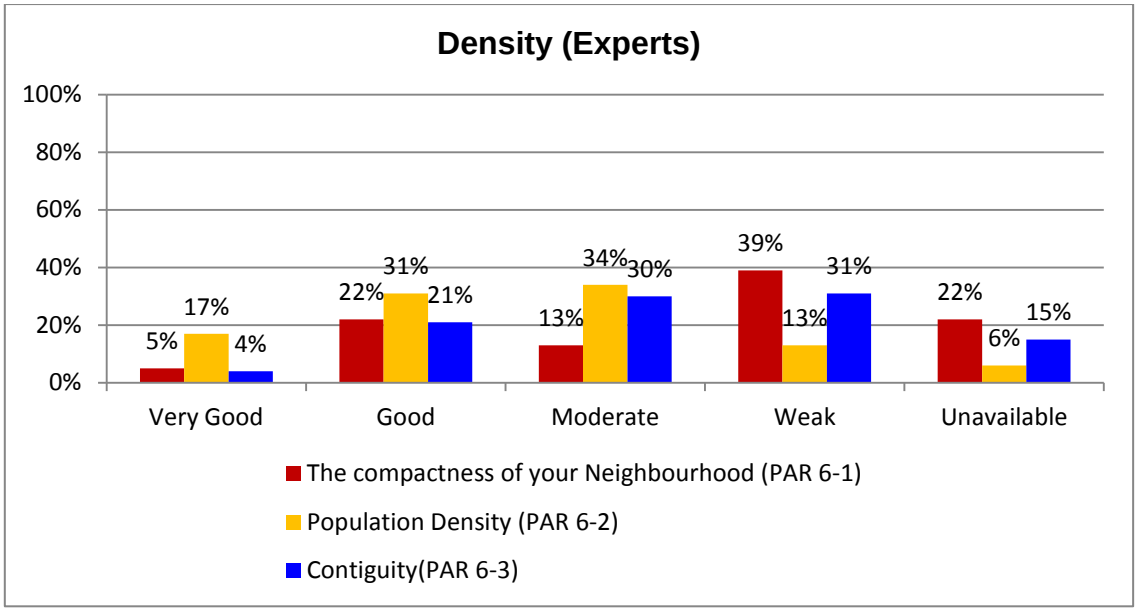


Figure 8.22: Experts Assessment, Density Percentages in the Residential Projects

According to the results in (Appendix 2), the density within the apartments and row-houses has indicated good percentages of 28% and 25% respectively. However, the scores remain at weak levels among the other districts with an average percentage of 10%. The results regarding duration of residence in the recent districts have reflected different responses. The majority of the respondents, who have been living in their current dwellings for less than four years, have inclined towards the high density concept with an average percentage of 23%. This was a clear indication for the growth of high-rise building types recently. However, the results regarding people who lived more than four years have indicated weak averages of 25% (Appendix 3).

The assessment of density in the recent projects has registered significant variation since it is basically related to the building type on one hand and the urban pattern that justifies the project contiguity. In Floria City, building density has registered good levels at 45%. However, the contiguity of the buildings scored a moderate percentage at 40%. Density in Ashti City 2 declined to a lower level compared to the previous project. Building and population density have registered weak levels on average 38%. In Park View, the scores were completely different. Building density

and contiguity scored 50%. However, population density remained at a moderate level at 40%. In the Italian Village, building and population density scored good levels at 40% and 48%. Finally, in Cihan City, building density and contiguity scored good levels at 50% and 43% respectively (Figure 8.23). In general, the level of density has registered an acceptable level due to the rise of land prices, investment-profit requirements, and the transformation in people's attitude towards encouragement of living in high-rise apartments. However, it is very important to accomplish objective studies regarding the relationship between the mass (buildings) and the void (surrounded area) to avoid insufficient proportions and provide adequate private spaces.

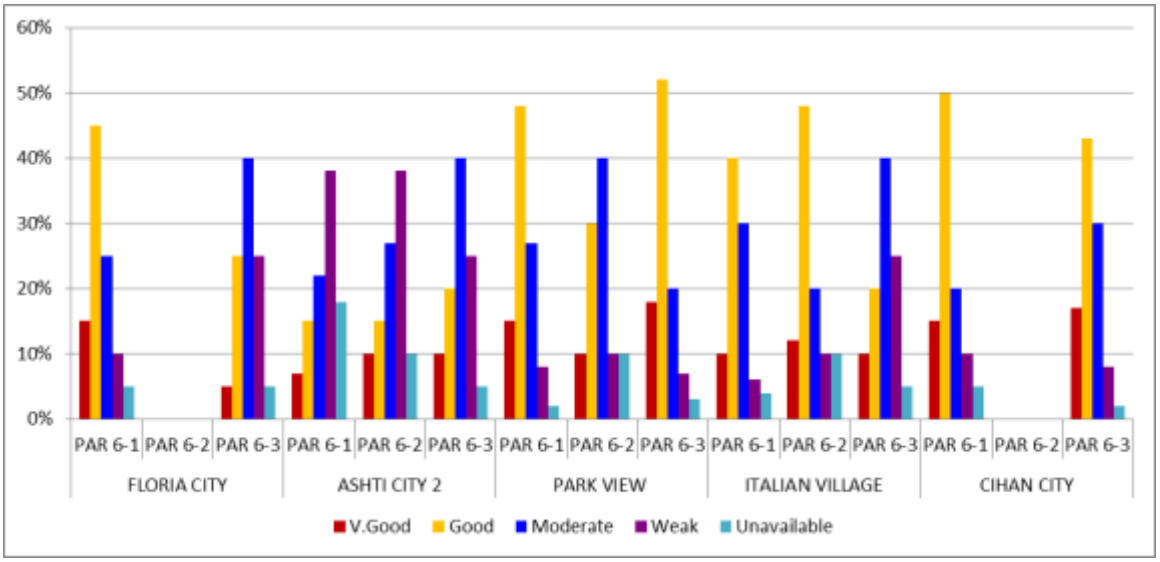


Figure 8.23: Qualitative Assessment of Urban Density in the Local Projects

Identity

Many scholars have noticeably emphasised the importance of a sense of belonging and attachment to a place as essential elements in achieving sustainable urban forms especially in historical and ancient cities (Neuman and Jennings, 2008; Kriken, 2010). Therefore, it is very important in the local residential projects to maintain a level of place-rootedness and belonging and increase identity and territorial

attachment accordingly. Unfortunately, as mentioned in chapter six and seven, most of the residential projects couldn't fulfil the requirement of this element, as the questionnaire requested participants to evaluate the current urban identity of their neighbourhoods. For the experts, there were more detailed questions regarding dynamic activities, meaning and symbols in their districts.

Users of the recent neighbourhoods evaluated urban identity in their district with dissatisfaction with weak percentages of 40% (Figure 8.24). Many users compared their current built environment to the previous traditional one in a dramatic way. A recent resident who lived in a traditional neighbourhoods states that "*When we moved away from our old dwelling, the avenue, we felt the difference. It isn't the same. There, everyone was watching each other's kids; it's just looking out for and helping each other. If you have a cohesive community, you feel safer, you're free*".

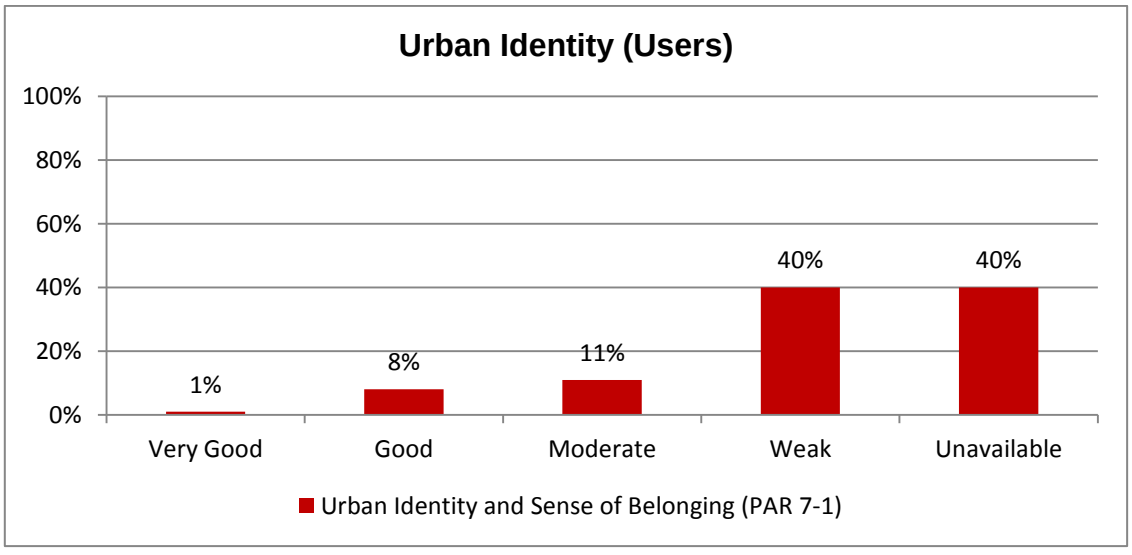


Figure 8.24: Users Assessment, Identity Percentages in the Residential Projects

The experts' assessments of urban identity were almost similar to that of the users except few differences. The majority of experts inclined towards highlighting the weakness of urban identity and the lack of meaning and symbols that characterised their districts with percentages of 55% and 39%. However, there were a few experts

who believe that dynamic activities like social attraction and liveability are still available in many recent projects with a percentage of 30% (Figure 8.25).

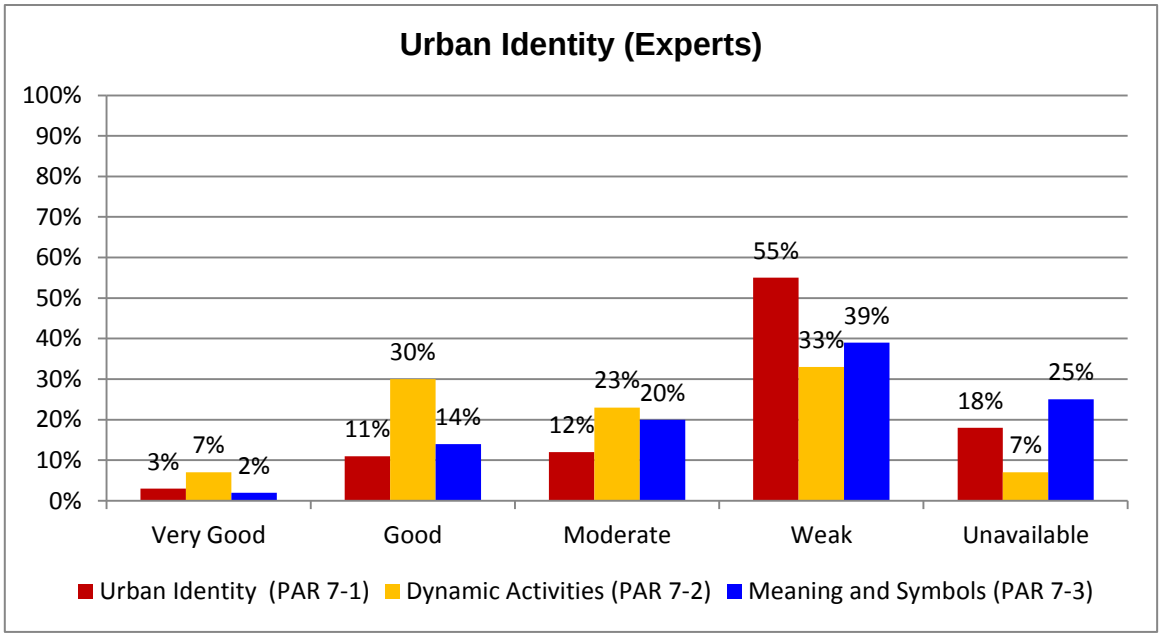


Figure 8.25: Experts Assessment, Identity Percentages in the Residential Projects

In terms of type of residence, the results were similar. All the percentages reflected the weakness of urban identity in the recent residential districts with an average score of 25% (Appendix 2). Regarding the duration of residence, this factor had a better effect on the sense of belonging and the attachment to the place in people who have been resident for more than 2 years at 10%. However, the majority of people (35%) who had resided in their district more than 4 years were still dissatisfied with the character of their district and sense of belonging to their new places (Appendix 3).

Urban identity has been assessed in the recent residential projects through the qualitative field survey. In Floria City, urban planning and architectural design were lacking features, characteristics and symbols that refer to the local context were at 45%. However, the dynamic activity wasn't explored since the project has not been occupied yet. In Ashti City 2, there were similar averages regarding identity features

and symbols at 48%. However, the dynamic activities registered moderate levels due to some social interaction, liveability and space containment of 40%. The averages in Park View continue to register lower percentages (50%) for identity features and symbols. However, the appropriate available landscape has raised the activities figures to 46%. Urban identity in the Italian village scored similar percentages regarding local features and meanings at 45%. However, the dynamic activities registered a moderate percentage at 40%. Finally, the urban identity in Cihan City wasn't at all better: identity features and local meaning were weak at 52%. However, the dynamic activities remain unexplored (Figure 8.26). In general, the performance of urban identity indicator has recorded the smallest percentage compared to the other indicators. This is probably due (as mentioned before) to the lack of preliminary studies during the briefing and primary stages on one hand, and providing a prepared western design set which unfortunately got the approval of the local authorities, on the other hand.

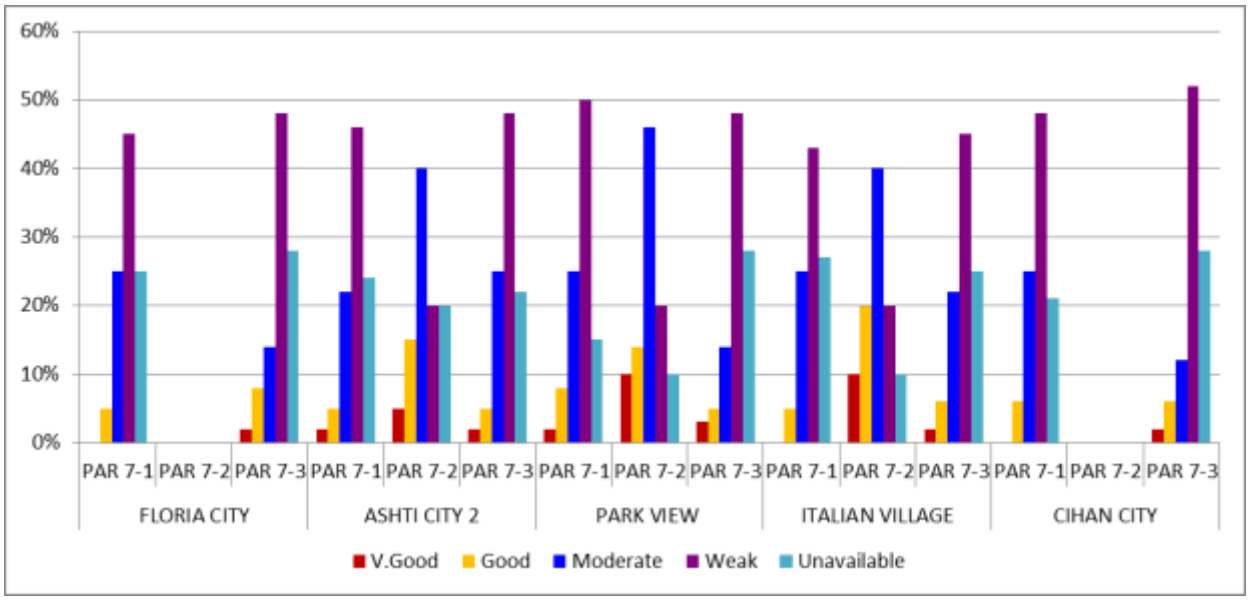


Figure 8.26: Qualitative Assessment of Urban Identity in the Local Projects

Adaptability

The issues of adaptability and futurity are essential to the planning and design of the sustainable urban form. Buildings' locations, management and maintenance, resilience and public participation are fundamental requirements for achieving the holistic sustainable objectives. Sustainable design, therefore, must be adaptable to these specific prerequisites of any built environment. In essence, to meet the challenges of tomorrow, cities in developing countries need to adopt an integrated approach to planning and sustainable development. Consequently, the questionnaire has focused significantly on the important issues related to this crucial indicator. There were three ultimate questions: the first is concerned with the applicant's attitude towards the location of his dwelling, the second has investigated the orientation and environmental characteristics, and the third has explored the effective participation of the people concerned in the planning and design process of their current residential blocks.

In the user's assessment, there was relative agreement among all participants about the adaptability issues (Figure 8.27). They have shown good satisfaction with the location of their dwellings at 40% and moderate opinion regarding the orientation at 31%. However, they have dramatically revealed the lack of participation in the planning and design of their districts at 69%. A young father who lives in one of the recent districts states that "*I've wished that we could describe how the site planning would look like and where to locate the schools and children's playground*".

The experts' assessment has shown a few differences from the users. They have impressively expressed their positive satisfaction with the location and orientation of their dwellings with an average percentage at 43%. They have also agreed on the lack of participation at 66%. However, there were moderate opinions regarding the

availability of good amenities and the maintenance and management of their projects at 36% and 35% respectively (Figure 8. 28).

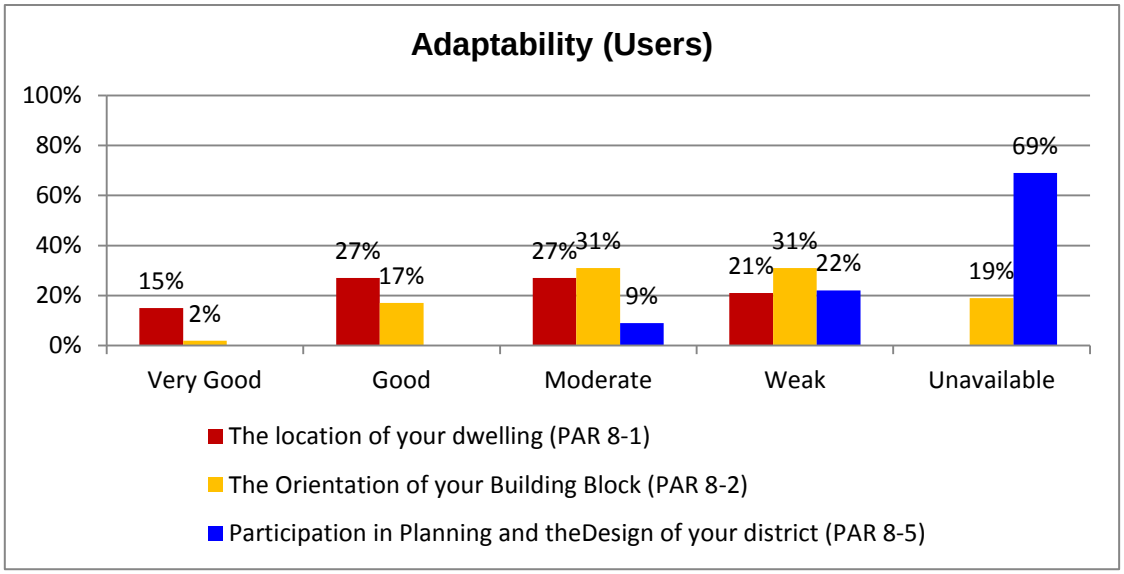


Figure 8.22: Users Assessment, Adaptability Percentages in the Residential Projects

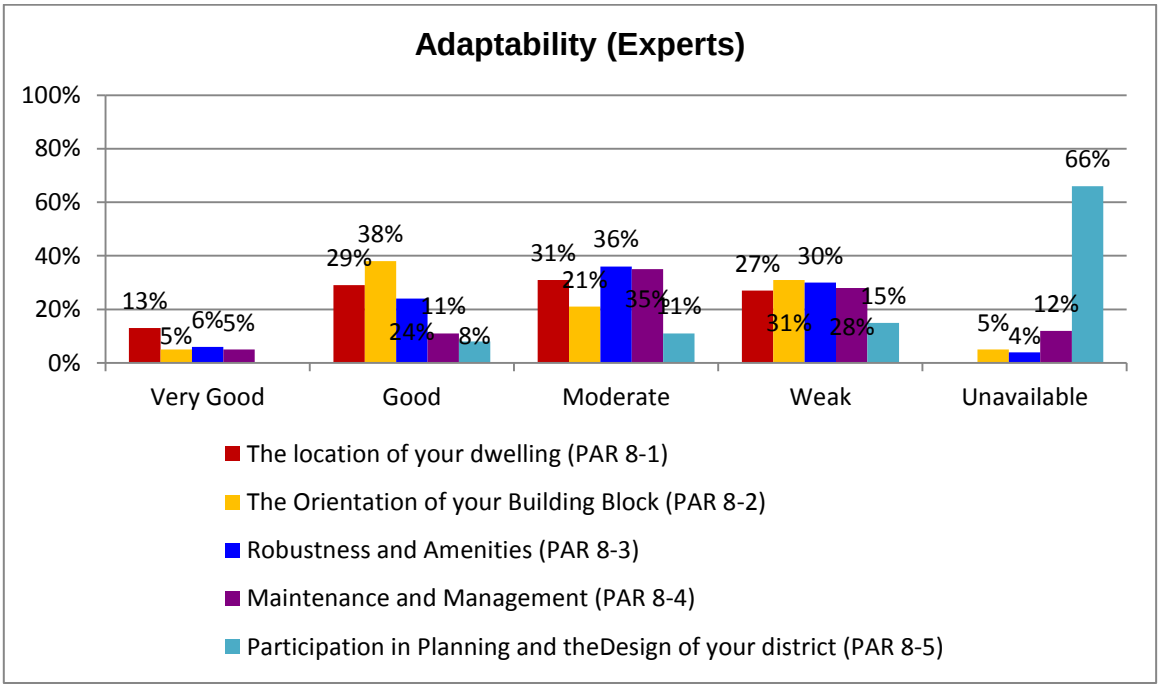


Figure 8.28: Experts Assessment, Adaptability Percentages in the Residential Projects

The location of apartments and row-houses has registered good levels with percentages of 28% and 30% respectively. In addition, building orientations were good calculated within the single-family houses with an average percentage of 28%.

However, this aspect registered weak averages within the apartments and row-houses of 18 and 25% respectively. The participation level was similar among all types with an average rate at 30% (Appendix 2). Regarding duration of residence, most applicants, regardless of the duration of occupancy, have had moderate attitudes towards the location and orientation of their dwellings with average percentages of 15% and 12% respectively. The results have revealed that both these factors had no significant variation on the previous results (Appendix 3).

The evaluation of this indicator in the recent projects was adopted by the researcher. In Floria City, the results show that the orientation and the amenities have scored good percentages at 45%, while the location scored a moderate percentage at 42%. However, the lack of participation scored 53%. The results in Ashti City 2 were lower regarding the location and the availability of amenities which scored 45% and 40 respectively. The orientation and project management have scored moderately with an average at 40%. The participation continues to be the lowest at 53%. The analysis of the results in Park View indicates good percentages regarding the location and the amenities at 53% and 48%, while the orientation recorded a moderate percentage of 40%. The lack of involvement is also considered a major issue in this project with a weak percentage at 55%. In the Italian Village, the location, orientation and the management of the project scored good percentages with an average of 40%. However, the amenities and the participation of residents have scored weak levels of 48%. Finally, in Cihan City, the location has recorded good levels at 40% while the orientation and the amenities have moderate percentages at 42% and 38% respectively. The involvement of the residents remains the lowest at 55% (Figure 8.29).

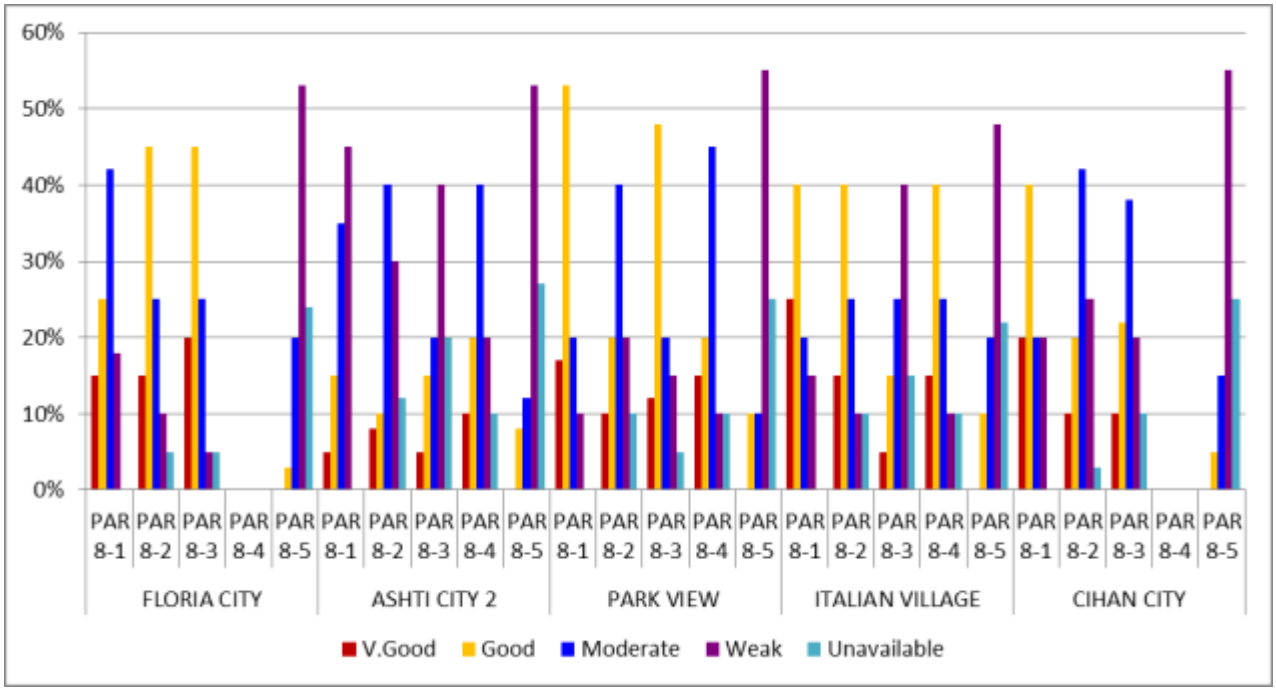


Figure 8.29: Qualitative Assessment of Adaptability in the Local Projects

In general, all the results have revealed the lack of public participation in the preliminary design process in all the recent residential projects. Regarding the other aspects of adaptability, there were significant variations in each element depending on the location of the project, the layout and building types. According to the previous analysis of the indicators performance in the various residential projects, the following chart (8.30) can be organised which indicates the variation of each indicator in the five selected projects.

One of the important objectives of the study is to examine the impact of urban pattern and layout on the performance of sustainable urban form indicators and to test the first hypothesis of the study which assumes that 'the spatial pattern of the urban form has an essential impact on achieving sustainable urban forms in the current residential projects in Erbil city'.

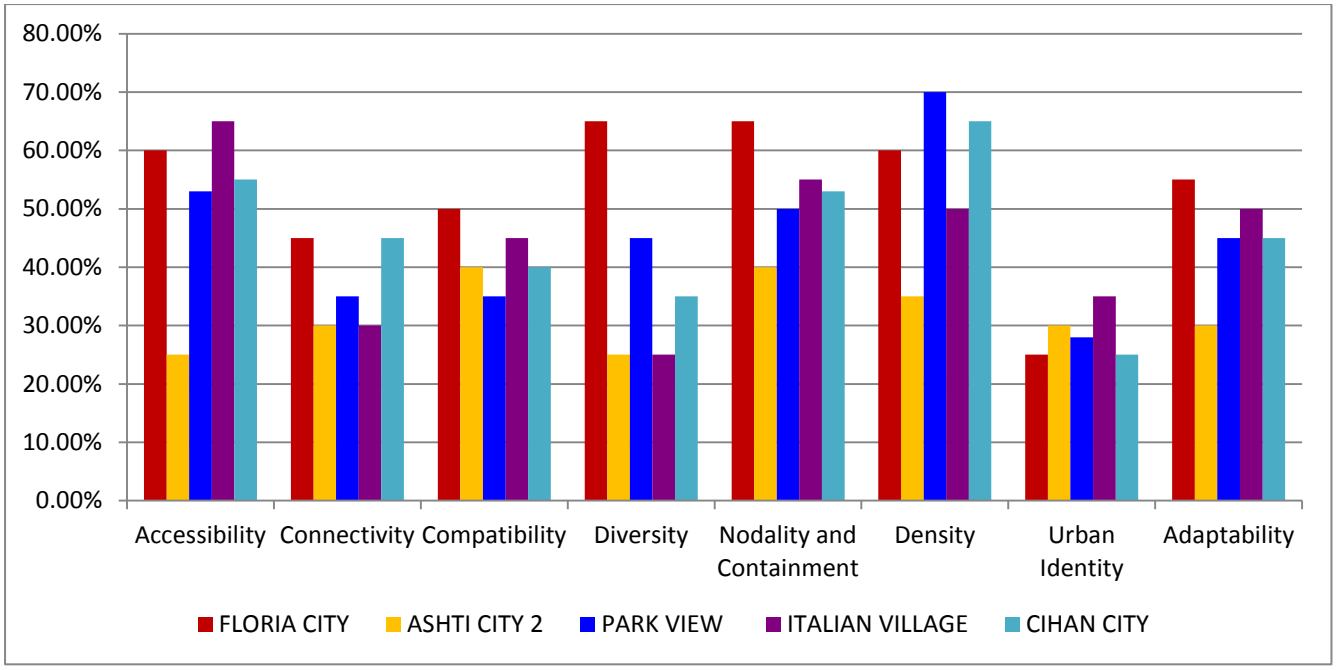


Figure 8.30: Summary of Percentages of the Quantitative Data Regarding the Performance of Indicators in the Selected Residential projects

To examine this relationship, one-way ANOVA analysis was conducted. This test analysed comparison of means to determine whether there are any significant differences between two or more independent (unrelated) groups. If the p-value is higher than 0.05 and F-statistics is around 1.00, this means that there are no statistically significant differences between group means and if it is less than 0.05, F-statistics larger, this would confirm the alternative hypothesis. In this study, there were two different groups; the projects and the indicators. All the variables were used and analysed through SPSS program.

The statistical results in Appendix 4 clearly provide evidence that there are significant variations in the parameters' means, standard deviation, standard errors, 95% confidence interval for mean, and the minimum and maximum of the theoretical range. The ANOVA results and the significance value was (F statistics between 4, 2 -20, 8 and P value < 0.05). These results indicate that there are statistically significant differences between the values regarding the means of the indicators (Figure 8.31).

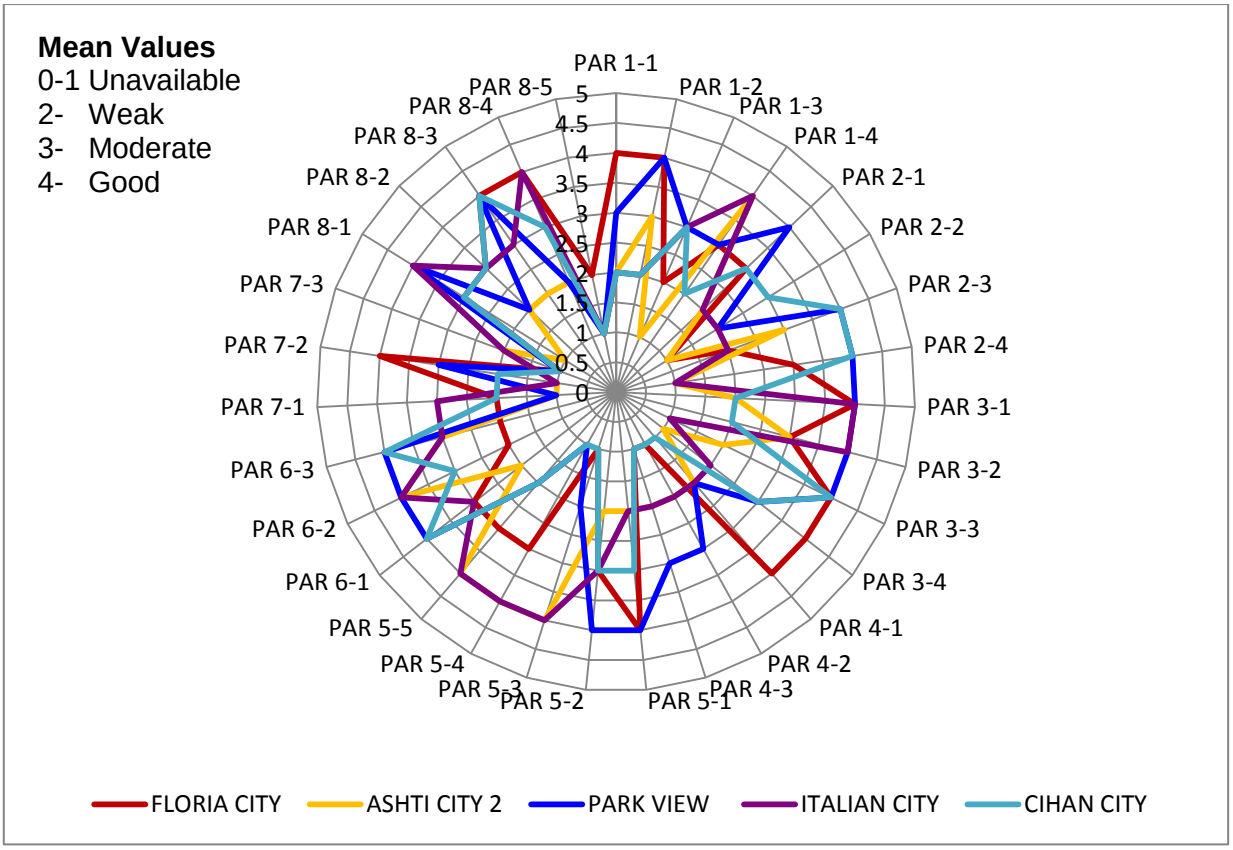


Figure 8.31: Sustainable Indicators Performance Comparison of Mean Values in the Local Projects

These results clearly provide evidence that there are significant variations in the performance of the sustainable urban form indicators in the various residential projects in Erbil city. This finding confirms the first hypothesis of the study and answers its third question regarding the significant impact of urban patterns in achieving sustainable urban form in Erbil.

Finally, the researcher has conducted a T-test which is a statistical examination and comparison of two variable means. The test examines the t-statistic, t-distribution and degrees of freedom to determine the significance of variation of the two groups and whether the parameters' means differ. Consequently, the indicators (Group 1) that have been examined in the questionnaire related to users' questions (2-1 to 2-16) and the similar equivalent parameters (Group 2) which have been tested in the projects assessment checklist (PAR1.1, PAR1.2, PAR1.3, PAR1.4, PAR2.1, PAR2.2, PAR3.1, PAR4.1, PAR5.1,

PAR5.2, PAR5.3, PAR6.1, PAR7.1, PAR8.1, PAR8.2, and PAR8.5) have been used in the independent sample T-test. The tables 1 and 2 in (Appendix 5) have shown the mean, standard deviation, standard errors, 95% confidence interval for mean, and significance of variation between the two groups. In most social research, the t-value has been set at the alpha level 0.05. The results have clearly provided evidence that there were statistically no significant differences between the means which were > 0.05. Moreover, many aspects like: interaction with neighbouring districts, urban identity and users involvement in the design, have registered minimum levels. Consequently, the results have clearly shown that the variation between the means for the two groups is close which would support the hypothesis of this study which determines that **the spatial pattern of the urban form has an essential impact on achieving sustainable urban forms in the current residential projects in Erbil city.**

8.3 Interviews

This section focuses on the analysis and results of the interviews. Simultaneously with the quantitative questionnaire, interviews with many academic architects, designers and decision makers were conducted to enhance the study with more reliable information. The main aim of the interview was to investigate the second hypothesis and answer the research question of whether there are any current specific approaches to how urban forms are spatially arranged to achieve an adequate sustainable performance locally?. Furthermore, the interviews were aimed at previewing expert's perceptions and attitudes regarding the current built environment of Erbil city. The first group are academic/field architects who have been teaching and working in Erbil for many years. The second group are the consultant designers who have been involved in the latest development of Erbil City and finally decision makers and real estate developers who have had significant impact on the policy, improvement and the future of housing in the city.

The interview method has allowed the researcher to obtain a large amount of significant data which was unavailable in the quantitative method and has supported the practical field studies simultaneously. Moreover, it has been assumed that some important information might have been excluded from the questionnaire, and then obtained instead through the interviews. All the results are highlighted and charted to arrive at an analysis and conclusion of the evaluation of the current local built environment on one hand and to address the practicing of the sustainable urban form indicators on the other hand. The list of interviews included 20 candidates; unfortunately only 14 experts were interviewed successfully. The interviews which were conducted were with decision makers, managers, scholars and consultant architects and planners. This has occurred due to the current hard situation that the region is witnessing politically, economically and socially. It is fair to say that, during the field study, the region was under the attack of ISIS groups and most of people and institutions were in panic and under pressure of war, in addition to the economic crisis with central government in Baghdad.

The questions were divided into three categories; the first was general questions regarding the applicants' previous experience in the region, the main problems and future actions relating to the local built environment. The second part was the most important since it focused on exploring the current planning approaches and model regarding the urban patterns of the residential projects. Moreover, it addressed how sustainable urban form indicators were perceived by the experts and how they have been practiced locally. Finally, the third section addressed some critical issues in the current residential context. These interviews were particularly valuable because they permitted the creation of a holistic vision and perception out of the participants' experiences of Erbil.

8.3.1 Issues Identified by the Interviewees

The first part of the interview revealed significant issues which are related to the built environment in Erbil city in general and to the current residential projects in particular. These issues can be divided into four categories environmental, social, economic, and institutional (Table 8.1).

Many issues have been repeated by different interviewees who have indicated the importance of these issues being considered in order to improve the current built environment. The other question in this part was concerned with the interviewees' future visions and their main recommendations to improve the current urban fabric.

Table 8.1: The Main Issues Derived from the Interview discussions

	Environmental Issues
	Inadequate and poor public transportation which has encouraged using private vehicles that causes more traffic congestion and air pollution. Lack of planning and site studies which are related to the environment. Residential building height can directly influence the distance between them, and then influence wind and sunlight permeability. Lack of appropriate public places and green areas within the districts of the city. The lack of interest in the environmentally friendly and energy renewable resources though the region which has all the capabilities to perform this approach. The urban peripheries expand randomly and they consume hundreds of hectares of farmlands and green areas, threatening the local environment and quality of life.
	Socio-cultural Issues
	Most of the recent housing projects were built by foreign construction companies using western and modern architecture without considering the socio-cultural and the local identity factors. Gated (or secure) communities have emerged in Erbil City recently in almost direct response to desires to achieve privatisation and secure districts. The loss of connection between those in privatised and traditional communities reduces social contact and weakens bonds of mutual aid and responsibility that are an important part of sustainable community living. The lack of scientific studies regarding users' behaviour, demands and attitudes which have led to incompatible dwelling planning and design.
	Economic Issues
	High cost of the currently available residential dwellings developed by private housing developers. Lack of adequate housing for low-income families. Urban nodes and open spaces have been utilised sometimes by other irrelevant functions (e.g. building additional blocks) to gain more profit for the investors.

	Institutional Issues
	Contradictions between government regarding housing policies and the lack of coordination between the predominant sector departments, municipalities, investment board, and centres of decisions. Relatively low levels of participation or lack of public involvement and participation in the decision-making and planning process. City government often do not show the authority, power, or resources to deal effectively with the infringements made by constructions companies. It also emerged during interviews that many architects, planners and stakeholders and decision makers lack sustainable urban form significant indicators . Available building regulations in Erbil lack sustainability codes and criteria. However, recycled materials have been used in a few limited projects (English village). The lack of important local services and facilities in each district which enhance the mixed-use and liveability of the local community. The lack of professional expertise committees who perform holistic scientific studies regarding the current residential projects to indicate whether they are appropriate locally and have been designed according to the latest sustainable criteria.

As for future actions, almost 72 % of the participants have focused on the collaboration and coordination between the various institutional committees. Meanwhile a majority (50%) insisted that the currently used law and legislation needs a holistic improvement to be compliant and compatible with the current local construction policies (Figure 8.32).

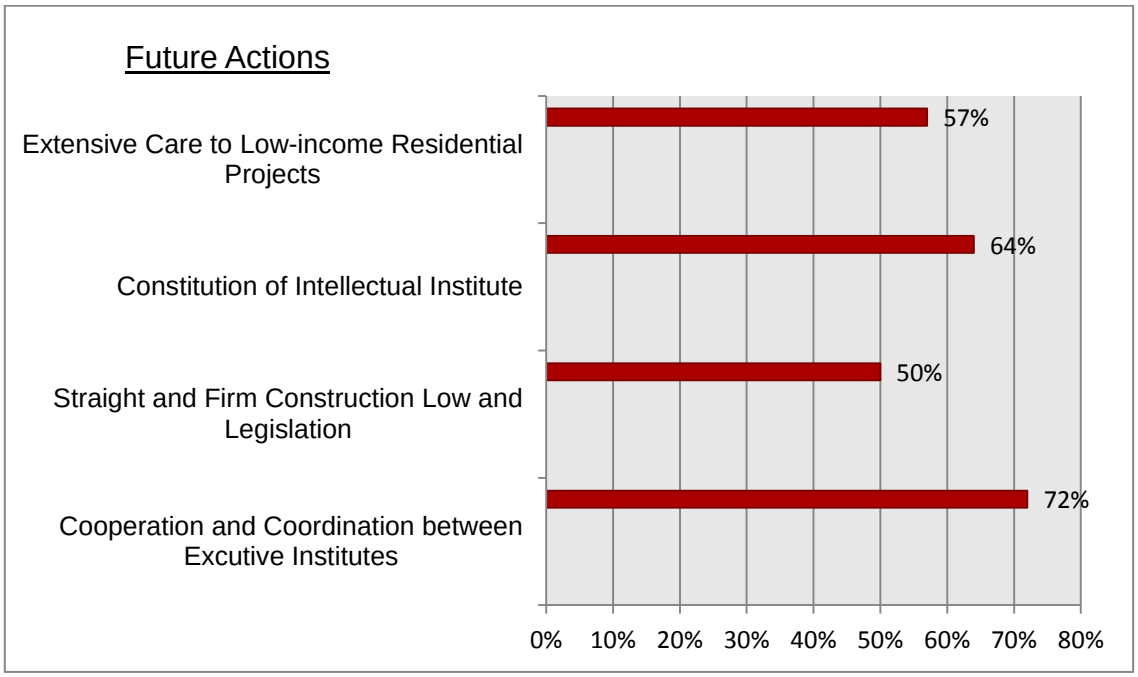


Figure 8.32: The Main Required Future Actions to Improve the Local Building State

There were more progressive steps proposed by various participants. A comprehensive table has been organized and the main issues have been categorised into four parts (Table 8.2). The first part focused on the environmental proposals to ameliorate the built form of the city, the second dealt with social suggestions, the third proposed economic solutions, and the last addressed the important institutional recommendations to enhance the administrative and executive structure of the city.

Table 8.2: The Main Future Actions Proposed by the interviewees

	Environmental Proposed Action
	Improve the current environment through the supporting of public transportation, creating more green areas internally and externally, and encouraging renewable energy resources. Preservation of farmland and maintain the quality of life.
	Social Proposed Action
	Enhance social interaction through creating social and liveable public areas.
	Economic Proposed Action
	Encourage the local construction companies which will allow creating more local jobs, producing cultural-related design concepts and refreshing the local investment.
	Institutional Proposed Action
	The cooperation and coordination between centre of decisions and executive institutions. Set and activate a firm construction law. Constitute committees which are responsible for control and inspection. Encourage people to take responsibility in the preliminary design process. Creating and supporting low-income residential projects.

8.3.2 Sustainable Urban Form Indicators

The second part of the interview as mentioned before focused on the importance of sustainable urban form indicators, the awareness of these dimensions and their practice in the current residential projects. Most of the interviewees were aware of the importance of achieving sustainable communities, but had less idea concerning the indicators that would

support this approach. Therefore, there were many important factors and dimensions undefined by the interviewees though the researcher repeated and explained the question clearly. The results in the next figure (8.33) indicate that 50% of interviews concentrated on urban identity as an important feature and indicator that is lacking in most of the current residential projects. However, indicators like the connectivity of districts and the compatibility within the urban fabric were ambiguously defined by most of the interviewees. This would reveal the lack of holistic agreement and understanding regarding the importance of the 8 attributes in achieving sustainable urban forms in Erbil City.

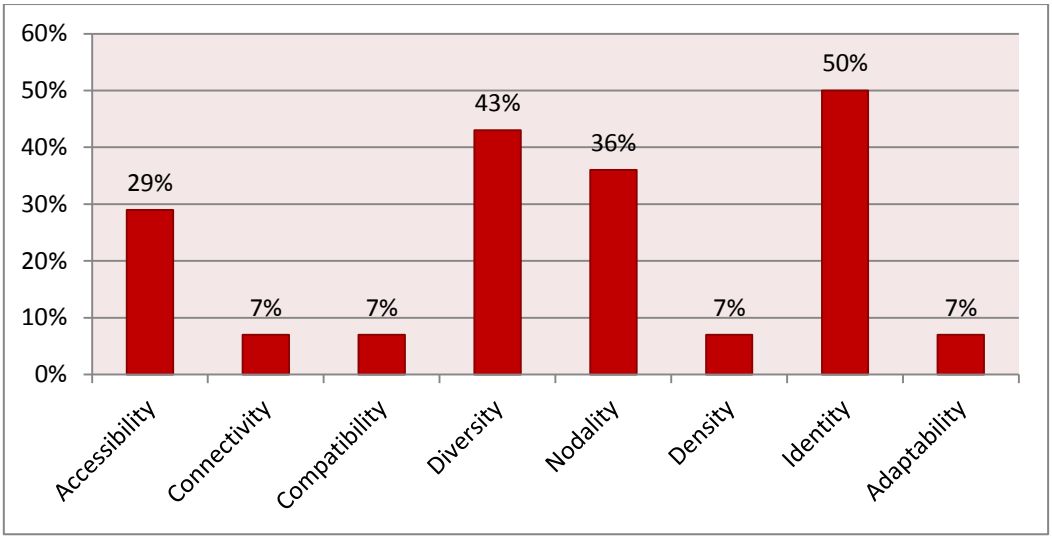


Figure 8.33: The Indicators Percentages Defined by the Interviewees

Furthermore, there were specific opinions by the interviewees which considered as an indication of the importance of the practical framework of this study, such as the following:

Accessibility:

- *The social image of public transport which means transportation education and awareness need to be increased among the population. People tend to demonstrate their enhanced income status by shifting from public modes to own vehicles.*

Connectivity:

- Rapid and Unplanned rural-urban migration, low employment opportunities and income inequalities produce more socio-economic disparities which are among the factors that cause more fragmented districts and encourage gated communities.

- It's about identifying the importance of positive social interaction with your neighbours, therefore we should facilitating and encouraging it.

Compatibility

- How could we evaluate designs that are far away from the local context?

- Most of the designs were approved by the Higher Board of Erbil Investment without rational studies and without depending on local design criteria and standards.

Diversity

-We need to think about old and disabled people when we design residential projects.

- It is important to provide the minimum requirements of daily activities.

Nodality and Containment

- It is completely essential to take into account the human scale in open spaces, and provide appropriate design and adaptability in the furniture as well.

- One of the successful principles in urban design is creating accessible, safe and attractive open spaces near residential buildings to achieve social places.

Density

- High-rise residential buildings do not fit here in our country. Many social, technical and maintenance issues occur and we still need more time to overcome these problems.

- Compact projects are very important to preserve land and provide more dwellings to improve the affordability of housing.

Urban Identity

-The loss of local identity is an important feature which characterises the recent residential projects in the region.

-The main aim of investors and contractors is to gain high profits and not to create successful projects belonging to the city.

Adaptability

- Recent projects in Erbil suffer from an underdeveloped legal system, lack of capable institutions and human resources.

- Most of the projects in Erbil City could not meet contract demands (completion, planning and design details, etc.) due to lack of impartial inspect committees.

Regarding the common local approaches and concepts in planning and buildings' layouts and whether there is a specific approach that is comparative with global experiences, most of the interviewees, 93%, have responded negatively and insisted that the current layouts are western metaphors. It is precise and confirmed that there are **neither systematic nor tested approaches of sustainable spatial pattern practiced in the current residential projects in Erbil city** which reject the determined second hypothesis (Figure 8.34). Therefore it is very important to ameliorate the local planning strategy according to the contextual factors which are suggested by the study.

There were other significant issues discussed with the participants related to specific sustainable concepts and whether they are well-considered in the current residential districts. Half of the interviewees, 50%, have encouraged the compact and high-rise residential buildings approach, but with complete caution to fulfil all the construction's requirements. Regarding the proper planning and design of urban nodes and open spaces

in the current residential projects, most of the applicants, 71%, have expressed their dissatisfaction towards the articulation of these areas and explained how these important areas are being improperly used. Project management and annual maintenance is one of the significant issues that have been argued with the interviewees. Most of them (79 %) agreed that most of the recent projects in Erbil city dramatically lack this important aspect.

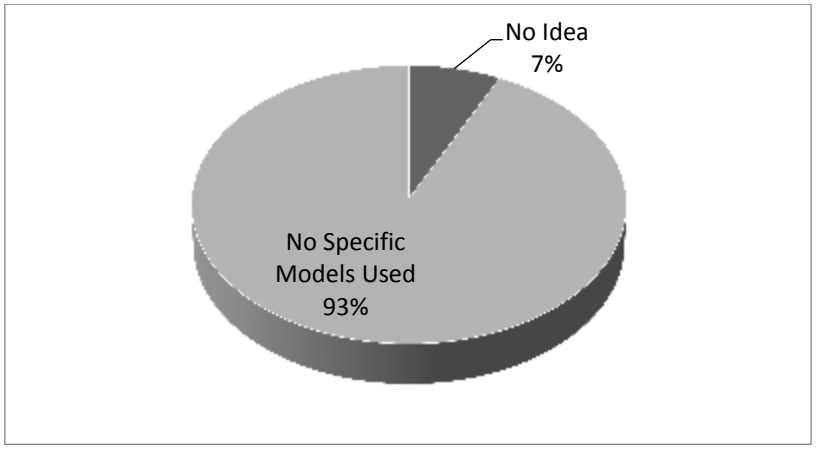


Figure 8.34: The Lack of Specific Building Arrangement in the Current Local Planning

8.4 Summary of the Key Findings

This section outlines the key findings of the research in the light of the research questions, research assumptions and objectives.

- The qualitative results and quantitative analysis have substantially indicated the importance of the practical framework in the assessment of the current residential projects in Erbil city on one hand, and proved how the experts have variously reacted to the applicability of each attribute in the local context on the other hand.

- The one-way ANOVA and t-test which were conducted to compare the mean values of sustainable indicators performance have strikingly revealed that there were statistically significant differences between the values. Accordingly, this would confirm the impact of the

spatial patterns of urban forms in achieving significant differences in the performance values of the sustainable urban form indicators.

- The interviewees' perceptions regarding the local planning process have asserted that the current planning schemes of the residential projects are western metaphors and most local planners, architects and urban consultants have admitted that these designs were previously borrowed by investors and foreign companies, arranged with few modifications, submitted to gain the approval of local authorities, and finally utilised in certain locations.

- The results of analysis of the new projects regarding accessibility have indicated moderate rates regarding access to the blocks and local services and lower percentages regarding access to public transportation and public spaces. In addition, the results have indicated that accessibility ranges have noticeably varied according to the type and duration of the residence. Local planners and architects have verified and explained that accessibility is inadequate due to the lack of preliminary holistic studies, and inadequate and inflexible planning schemes.

- According to the qualitative and quantitative data analysis, connectivity results have revealed controversial and remarkable issues. The internal connectivity between building blocks is acceptable and well-defined, whereas they are almost isolated and separated from the neighbouring districts through high concrete fences and guarded gates. Nevertheless, this issue is considered a double-edged sword since the fence provides a safe, secure and protected district but, at the same time, decreases the social cohesion and interaction with other neighbourhoods and communities. In addition, the results have indicated lower impacts regarding the type and duration of the residence on the connectivity of the project.

- The current built environment in Erbil city has indicated characteristics of disharmony between: the mass and the surroundings, façade design and local identity, and human

scale and the provided open spaces. Undoubtedly, the pre-conceptual spatial layout of the buildings has played a critical role in these issues which have appeared due to the lack of rational preliminary site and design studies and the lack of relevant and intelligent planning committees. However, there were a few positive features which enhance the current projects like: the imageability and legibility of the masses and the richness in the architectural and landscape details.

- Most of the participants were satisfied regarding the provision of local daily facilities in the most recent projects but it still lacks completion since there were many unavailable important facilities and entertainment activities. Furthermore, the vibrancy of population has registered lower percentages due to the lack of appropriate facilities and the isolation of the district to security reasons. The duration of residence had no marked impact and registered similar percentages. However, the type of residence had disappointing percentages within the apartment's areas.

-The current available planning schemes of the new residential districts have indicated appropriate public areas and green spaces. Pedestrian pathways have been provided, but are improperly designed and incorrectly used. Furthermore, these important corridors have been used as car parking due to the increasing number of private vehicles per household and lack of unavailable adjacent car parking. The field study has simultaneously revealed the lack of cohesive social interaction among the users of the new residences. This issue is probably due to the inadequate social spaces, diverse background of the residents and the lack of proper management which occasionally encourages social activities and facilities in certain periods of the year. However, the impact of the type of housing and duration of residence had remarkable percentages regarding human scale and provision of social privacy aspects.

- According to the site survey and users' opinions building compactness and population density have registered good values in high-rise projects. However, diverse building type was an important factor in the selection of the projects. The spatial arrangement of the buildings inclusively refers to the proper layout of the blocks horizontally and vertically. In this sense, the current patterns of the residential projects couldn't attain the minimum standards of solid and void mass, positive and negative space, and building contiguity requirements. The duration of residence was an interrelated factor since most of the recent residents occupied high-rise buildings.

- According to the analysis of the results, although urban identity is regarded as one of the essential indicators by most of the local experts, this attribute has registered the lowest performance in all of the housing types compared to the indicators. The current residential projects couldn't manage to preserve the uniqueness and richness of the local historical built environment. However, the duration of residence registered better percentages among the residents who have been living in their current locations for longer years.

- The quantitative and qualitative analyses have dramatically revealed weak and insufficient performances of the factors under this aspect. Elements like project management, building maintenance and public participation have registered low values in all the types of the implemented projects. Most of the policy makers, planners and architects have agreed and confirmed the role of these aspects in creating the evolution of the character of the new sustainable communities or "the future urban fabric". However, the type of residence had a significant impact on enhancing the quality of urban development, related to the location and the orientation of many recent projects, and raised their quality and importance locally.

8.5 Summary

This chapter presented the analysis and findings, complemented by the discussion, of the research results of the quantitative and qualitative field studies. The chapter is structured into three interrelated parts, the questionnaire analysis, field study assessment, and the interview results.

The first part was the questionnaire study and analysis of 252 participants. This section was composed of eight directories which represented the sustainable urban form indicators. The analysis has been supported by tables and charts to show clearly the presentation of each factor. The second part presented the qualitative study adopted by the researcher to assess the each attribute in the selected projects. The findings have statistically indicated the variation in the sustainable urban form indicators according to the variation in the urban patterns.

The second part of the chapter focused on the results of the interviews which were conducted with 14 selected architects, planners and decision makers. The analysis depended on the three relative sections that the interview questions addressed. The findings have clearly indicated the lack of systematic local planning approaches in the development of residential projects. Furthermore, numerous perceptions regarding the current built fabric of Erbil city and different attitudes regarding the practical framework of indicators have been presented.

Chapter 9: Conclusions and Recommendations

9.1 Introduction

Chapter nine highlights the research conclusions and key findings. It attempts to authenticate the main assumption of the study and discusses the manner in which the study has answered the research questions. The chapter also produces a sub-set of policy and design guideline recommendations based on both the qualitative and quantitative case-study examples. Finally, it indicates the research contribution to evaluate the built environment in Erbil city in the context of sustainability and presents relevant propositions for future research.

9.2 Research Conclusions

Depending on the research key findings which have been discussed previously, this section presents the relevant conclusions which are formulated to provide the sufficient evidence to authenticate the research statements.

1- The practical framework of sustainable urban form indicators composes of eight interrelated attributes: accessibility, connectivity, compatibility, diversity, containment, density, identity and adaptability. These dimensions have been globally monitored and locally tested. The results in both contexts were extraordinarily relative and substantial. This evokes an important contribution of this study to the knowledge which concludes that these indicators which have been successfully applied in the developed countries can be similarly adopted to evaluate and create sustainable urban neighbourhoods locally and consequently in the developing countries.

2- Depending on the quantitative analysis, the results clearly provide evidence that there were significant variations in the performance of the sustainable urban form indicators according to different residential patterns and layouts in Erbil city. This finding confirms that

the spatial patterns of urban form have significant impact on achieving sustainable urban forms in the city of Erbil.

3- The study has revealed that there are neither systematic nor tested approaches to sustainable spatial pattern practiced in the current residential projects in Erbil city depending on the empirical findings of the qualitative study. Therefore, the study has dramatically shown that the majority of these concepts have failed to fulfil the socio-cultural, physical and behavioural demands of their residents.

4- In terms of accessibility, the quantitative results indicate a satisfied percentage in the current projects except the access to public transportation. The spatial patterns and the type of housing have major roles on the performance of this indicator.

5- The internal connectivity performances have indicated good percentages among the current projects. However, most of the recent residential projects lack the connectivity and integration with the neighbouring districts, providing instead more secure and private areas. In addition, the results have indicated lower impacts regarding the type and duration of the residence on the connectivity of the project.

6- In terms of Compatibility, the quantitative results have shown weak performances regarding most of the aspects related to this indicator. However, the type of residence had a noticeable impact on the results especially within the high-rise residential projects where imageability and legibility scored good percentages.

7- In terms of diversity, the provision of local daily facilities in the most recent projects indicates good percentages but it still lacks completion of facilities and vibrancy of users. Furthermore, the duration of residence had no marked impact and registered similar percentages. However, the type of housing had noticeable impact on the performance of this attribute.

8- The performance of urban nodality and containment has indicated weak performances though open spaces and green areas were well-defined in the recent projects. However, the impact of housing type and duration of residence on the performance of this attribute were noticeably significant.

9- In terms of density, the quantitative analysis indicated acceptable percentages among the selected projects. Furthermore, there was a noticeable transformation in people's attitude towards encouragement of living in high-rise apartments which would assert the importance of the type of residence in achieving noticeable differences.

10- The study has dramatically revealed the weakness of the current planning schemes and architectural design to provide features and treatments which reinforce the sense of local identity. This issue evokes a genuine commitment and responsibility of the local authorities to reconsider their strategies regarding the achievement of successful sustainable.

11- In terms of Adaptability, the performances were weak and insufficient regarding most of the elements especially public involvement in the preliminary design process of all the recent residential projects. However, the other aspects of adaptability, there were significant variations according to the type of residence which would enhance the quality of these projects.

9.2.1 Relationship between Urban Pattern and Sustainable Urban Forms

The hypothesis formulation was guided by claims raised by previous research which focussed on similar issues. As discussed in Chapter Five, the research has partly supported the hypothesis that "the arrangement of urban pattern and high performance of the sustainable indicators have a significant impact on achieving sustainable urban forms". This assumption was theoretically supported through the analysing of global experiences which have revealed the importance of these sustainable dimensions to improving the quality of life in the residential quarters of the developed countries. According to the

empirical results, this assumption was totally correct, since all the data and its analysis have proved the crucial impact of the sustainable indicators in achieving sustainable urban form locally.

The second hypothesis, which claims that, there is a general and sustainable spatial pattern model which is observed in the current residential projects in Erbil city has been significantly rejected**.** According to site observation and analysis on the one hand and the relevant information which was obtained from the interviewees in Chapter Eight, the study has proved that most of the recent residential projects are western metaphors, which change dramatically according to the investors technical and economic demands.

9.2.2 Discussion of the Research Objectives

In the first chapter, the study has determined the main aim of this study was to explore the relationship between urban pattern and sustainable urban form and to evaluate the current local urban form and pattern approaches in terms of sustainability and to eventually compare these approaches with the global orientations that will enhance urban sustainability and ensure a sustainable urban form. To fulfil this ultimate aim, the study discussed and achieved the following objectives: -

- In chapter two, three and four, the researcher discussed and analysed the different attributes which are related to the urban form problem context. In addition, the study has addressed the various approaches and concepts related to the patterns and arrangements of urban forms. Furthermore, the study has demonstrated the essential studies and different types of sustainable urban form concepts which are reviewed by the literature supported by virtual examples. The spatial arrangement of urban forms in these approaches was investigated to derive the common dimensions and indicators which are considered the most important factors in the assessment of sustainable communities. Moreover, these

argumentation chapters have sown the first seeds to address and conquer the relationship between the spatial arrangements of urban fabric and these significant indicators.

- In chapter five, and depending on the previous theoretical vision, a practical framework of sustainable urban form dimensions has been generated. These indicators were the central core to test the relationship between the urban pattern and its role in achieving sustainable urban forms and to assess the built environment in these neighbourhoods. This practical framework was successfully applied and tested which would raise its validity and reliability regarding the residential communities in the developed countries. In chapter eight, the study has proved that this framework and its integrated dimensions can be tested in the local context.

- In chapters seven and eight, the researcher discussed theoretically and practically the role of urban layout on the performance of sustainable urban form indicators. The study has revealed the significant relationship between urban patterns and sustainable urban form. The research has also demonstrated how sustainable urban form indicators performed and varied when applied in the residential districts of the local context. The results of the quantitative and qualitative studies in chapter eight have noticeably indicated the variation between the values for the two groups was different to support the first argument of this study which claimed that “the spatial pattern of the urban form has an essential impact on achieving sustainable urban forms in the current residential projects in Erbil city”.

- According to the qualitative study, the main results have indicated that the currently applied planning schemes, urban patterns and architectural designs are insufficient locally in terms of sustainability. The empirical findings and experts attitudes in chapter eight enhance the argument that claims that there is no specific planning model or approach regarding the sustainable spatial pattern of urban forms in the development of the current

residential projects. Hence, most of the present concepts are considered incompatible and irrelevant to the local context.

- Depending on the performance of the practical framework and according to the main key findings of this study, a set of comprehensive recommendations and applicable design guidelines are created. These operational directions will act as a reference for local government to formulate their management and policies regarding the current built environment of Erbil city.

9.3 Recommendations

Based on the key findings of this study, practical recommendations are formulated and directed to the local planning authority and other relevant government institutions to improve the current local built environment in the context of sustainability, and increase eventually the quality of life in the residential quarters. Although some of these guidelines are already included in current national and local policies, it is required to emphasise the importance of the implementation and monitoring process of these strategies to ensure the highest requisite efficiency. To achieve the final objective of this study, this section provides important guidelines that will enhance the quality of the local built environment:

- **Urban Planning**: it is very important to constitute professional committees which are responsible for inspecting the planning schemes and their relevance and attachment to the local context. These institutes should undertake an efficient effort to manage and improve the planning and design procedures among the consultant bureaus. Furthermore, the planning departments and architectural consultant offices are required to carry out comprehensive preliminary project studies related to the practical attributes suggested by this study.

- **Sustainable Urban Form Indicators**: several themes in the local context have been targeted in order to improve on the current existing planning developments which are

associated with the sustainable urban forms of the residential neighbourhoods. These areas are divided into eight attributes: accessibility, connectivity, compatibility, diversity, nodality and containment, density, identity, and adaptability.

- **The Spatial Patterns of Urban Form**: this aspect has been proved a significant aspect in achieving sustainable communities and should be seriously considered and thoroughly performed in the planning of the contemporary residential buildings.

- **Local Approach to Achieving Sustainable Urban Forms**: There should be systematic and tested approaches to a sustainable spatial pattern of urban form approach. These approaches need to be modified and improved to suit the contextual factors and the practical framework suggested by this study to manage the development of the current residential projects in Erbil city. Planning departments at the Governorate, Ministry of Housing, and the Municipalities are responsible for improving these models depending on the project type and the local context.

- **Performance of Sustainable Urban Form indicators**: The study has investigated the relationship between urban patterns and their role in achieving sustainable urban forms through eight interrelated themes. Further recommendations and design guidelines are formulated to enhance and improve the current residential buildings in Erbil city.

1- Accessibility

- Improve the overall access to local services and public facilities within the residential neighbourhoods. Moreover, provide direct (as far as possible), safe, and convenient pathways between residential blocks and public facilities. Accordingly, the residents of the neighbourhood will consider walking up to 400 m (approx. five minutes) for daily activities, or 800 m (ten minutes) to the nearest public transport or the district centre.

- Develop a well-defined and qualified public transportation system which depends on providing reliable and convenient buses to connect the centre of each community with the

main central station of the city. On top of that, residents should be encouraged to walk or use public transport which passes closer to their districts and not depend so much on private vehicles.

2- Connectivity:

- Affording high levels of connectivity will help to create accessible, liveable, and ecological communities. In this sense, the street network and internal corridors should provide a high level of connectivity between the internal blocks on one hand and with other adjacent neighbourhoods on the other hand. Consequently, residential development policy should avoid the complete gated community formats and encourage and maximise good linkage to the neighbouring urban areas.

3- Compatibility:

- This element is promoted to minimise the negative impact of the building-surroundings relationship on users and visitors' perceptions. Scale, proportions, colours, materials and the architectural details of the new districts could be adopted to integrate more coherently with the local context.

4- Diversity:

- Provide all the important facilities, adequate services, competitive daily needs, and entertainment activities within accessible locations and adequate safe distances on one hand and increase the residents' awareness of how to utilise districts' services to increase the vitality and liveability of the local neighbourhood on the other hand.

5- Nodality and Containment:

- Open spaces, green areas and children's playgrounds are envisioned as essential aspects of the public realm, which improve the connectivity of the district zones, enhance the social sustainability, and increase the distinct character and the sense of place. To improve community wellbeing the planning, urban pattern and detailed design of new

residential villages should include appropriate connected nodes of open spaces and green areas which encourage physical, social and cultural activities. In addition to this, local management and annual maintenance would contribute to increasing the quality and efficiency of these dynamic areas.

6- Density:

- Provide a variety of housing types and densities particularly around activity centres and public transport nodes to encourage diverse and integrated communities. These diverse blocks can be catered to with accessible public open spaces which are connected with networks of protected and convenient pedestrian pathways. A neighbourhood with a good mix of unit types will feature both flats and houses of varying sizes. Mixed land use and densities have a significant impact on the propensity of the residents to use services and local facilities located within their neighbourhood, and provide a range of housing types to sustain a vibrant city.

7- Identity:

- The preservation of urban identity and the community's sense of place through the use of physical and historical features which reflec the local character and city image. Moreover, to enhance important characteristics like meanings, landmarks, construction materials and retain unique dynamic aspects like liveability, permeability, and cultural significance to make the neighbourhood memorable and discernible.

8- Adaptability:

- The appropriate orientation, alignment and dimension of the site, and using sustainable materials and building technologies would improve the resilience of the project. Project management and annual maintenance create more adaptive projects through good responsible project administration.

- Participation is sustainability, hence, it is totally essential to encourage beneficiaries to participate in the planning and design process. The participation should not be limited to information, but to an active involvement by all residents in the urban development and in the decision making process. Importantly, the local authority, decision makers, and stakeholders are completely responsible for facilitating and motivating the stewardship of this significant issue through local media, agencies, and advertisements and brochures.

9.4 Contribution to Knowledge

In this section, the study describes the main contributions of this research to the literature. These key contributions mainly focus on three interrelated parts; the urban pattern, sustainable urban form, and the current built environment of Erbil city. These efforts are summarised as follows:

1- In terms of theoretical efforts, the study has developed a holistic theoretical framework which defines and elaborates all the concepts and attitudes that are related to sustainable urban forms and the spatial arrangements of urban form approaches. Furthermore, the study has generated a practical assessment framework which consists of eight interconnected indicators. These sustainable urban form dimensions were collected and developed depending on literature and practical endeavours. This developed framework could serve as descriptive guidelines in the residential building codes and act as a documentation model for achieving sustainable built forms.

2- The study has applied the sustainable urban form indicators to examine the relationship between the spatial patterns of urban form and the development of sustainable urban forms in one of the most rapidly growing cities in the developing countries. According to the quantitative and qualitative findings, the study has provided statistical evidence regarding the crucial role of urban patterns in achieving sustainable urban forms in the residential

districts. This attribute has evoked the importance of the thesis effort in the assessment of similar built environments.

3- The study has demonstrated general and specific design guidelines depending on the performance of the sustainable urban form indicators locally. These guide lines are considered an essential contribution to improving the current built context locally, and consequently may be utilised to increase the quality of the built environment in other developing countries.

4- In terms of research methodology, the study has adopted the mixed-method approach to investigate the relationship between spatial patterns of buildings and sustainable urban forms. The integration of the results assembled by the quantitative and qualitative approach has accumulatively contributed to the rigor of the study.

9.5 Future Implications

This research aimed to evaluate the current built environment in Erbil City in the context of sustainability. The application of the sustainable urban form indicators and analysis methods has been devoted in this research to the built environment of Erbil City. Certainly it would be valuable to apply these methods in other urban contexts to allow a much broader perspective of current residential environments and compare trends in Erbil with other city-regions. Furthermore, the previous chapters have opened extended horizons to unexplored areas. Following this, there are several areas that can be expanded from this study for the scope of future research. Firstly, this study only explored the performance of sustainable indicators in the residential districts and ignored the historical city centre and other public areas. This approach has the potential to be further developed. Secondly, Jenks argues that “The role of density is at the heart of sustainable urban form debate” (Jenks, 2010, P.148), moreover, most recent residential projects are encouraging the high-rise trend. In this sense, it is very important to explore other sustainable indicators related to building

types and how to achieve better quality of life in these residential contexts. Finally, many of these research indicators have approached directly or indirectly the meaning of social sustainability. There is general consensus among scholars regarding the importance of residential stability. This study may guide other researchers to address issues of residents' behaviour and community stability depending on the sustainable indicators mentioned.

9.6 Research Limitations

There are several limitations of this research that the author believes have had some impact on the final outcome. In terms of methodological limitations, the interpretation of results in the quantitative part of the study was based on empirical evidence obtained through the questionnaire and the interviews. Due to the current situation in the region politically and economically, the participation of applicants and interviewees was under the acceptable limits. Therefore, the researcher would have more information and richer findings if the context was more stable. Furthermore, due to the scope of the study and the time –scale of the PhD, the researcher would also have gained more information if the study covered a wider range of locations and other low income projects.

There is another important limitation, also related to the quantitative data collection: the evaluation of sustainable urban form indicators based on user participation, as the subjective evaluation by users and other unspecialised applicants may not represent the true performance of these dimensions. Finally, the observation and evaluation of the 34 sub-indicators in five different projects have been done sometimes subjectively, since some dimensions were immeasurable. This might have not represented accurate results. However, Yin (2003) has argued that the combination of subjective and objective assessment of variable performance can provide more comprehensive and accurate evaluation of these factors in the same context.

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PUBLISHING:1

AUTHENTICITY, IDENTITY AND SUSTAINABILITY IN POST-WAR IRAQ: RESHAPING THE URBAN FORM OF ERBIL CITY

Rebwar Ibrahim
Department of Architecture and Built Environment
University of Wolverhampton, Wolverhampton, UK
e-mail : rebwar_i@yahoo.com

Sabah Mushatat
Department of Architecture and Built Environment,
University of Wolverhampton, Wolverhampton, UK
e-mail : S.Mushatat@wlv.ac.uk

Mohamed Gamal Abdelmonem
School of Planning, Architecture and Civil Engineering,
Queen University, Belfast, Northern Ireland
e-mail : m.gamel@qub.ac.uk

Received: August 22nd 2014 ; **Accepted**: October 9th 2014; **Available Online**: December 15th 2014

Abstract

Issues of authenticity and identity are particularly significant in cities where social and cultural change is shaping active transformation of its urban fabric and structure in the post-war condition. In search of sustainable future, Iraqi cities are stretched between the two ends of the spectrum, authentic quarters with its traditional fabric and modern districts with their global sense of living. This paper interrogates the reciprocal influences, distinct qualities and sustainable performance of both authentic and modern quarters of Erbil, the capital of the Iraqi province of Kurdistan, as factors in shaping sustainable urban forms for Iraqi cities. In doing so, the paper, firstly, seeks to highlight the urban identity as an effective factor in relation to sustainable urban form. Secondly, the city of Erbil in Iraq has been chosen as a field study, due to its regional, social, political and historical role in the region. Thirdly, the study emphasises the dynamic activities and performance of residential projects according to rational sustainable criteria. The research concludes that urban identity and the sense of place in traditional and historical places should inform design strategies in order to achieve a more sustainable urban context.

Keywords: urban identity, sustainable urban form, Erbil, built fabric, traditional districts, Iraqi cities.

Abstrak

Isu keaslian dan identitas menjadi bagian signifikan di kota-kota di mana terdapat perubahan secara sosial dan budaya yang membentuk perubahan besar pada struktur perkotaan menjadi kota fabrikasi pada kondisi pasca-perang. Dalam usaha untuk menjadi kota yang berkelanjutan, kota-kota Irak yang membentang antara dua ujung spektrum, merupakan perpaduan antara area fabrikasi tradisional dan area modern dengan karakter global pada hunian mereka. Makalah ini menggali pengaruh timbal balik, kualitas yang berbeda dan tampilan yang berkelanjutan baik dari area asli maupun modern dari Erbil, ibukota provinsi Irak Kurdistan, sebagai faktor dalam membentuk kota yang berkelanjutan untuk kota-kota di Irak. Pada tahap awal, makalah ini menyoroti identitas perkotaan sebagai faktor yang efektif dalam kaitannya membentuk kota yang berkelanjutan. Kedua, kota Erbil di Irak telah dipilih sebagai objek studi, karena wilayah tersebut berperan dalam bidang sosial politik serta sejarah. Ketiga, penelitian ini menekankan pada kegiatan dinamis serta tampilan proyek-proyek perumahan yang sesuai dengan kriteria berkelanjutan yang rasional. Hasil penelitian ini menyimpulkan bahwa identitas perkotaan dan kesadaran akan tempat-tempat tradisional yang bersejarah harus memberikan strategi desain untuk mencapai konteks perkotaan yang lebih berkelanjutan.

Kata kunci: identitas perkotaan, bentuk kota berkelanjutan, Erbil, bangunan fabrikasi, daerah tradisional, Kota-kota di Iraq

Introduction

The term "Identity", has for long been the central concern of researchers in urban studies, built environment, architecture, planning sociology, and environmental psychology where it encompasses an essential character related to humanity [1]. Images and appearance influence the sense of place, whereby users can recognise and navigate legible places according to their organisation and rationality of their design [2]. Identity however, is not merely a quality of the physical place, as it fundamentally relates to both activity and personality. Sense of identity relies equally upon the observer's context

PUBLISHING:2

Cities 49 (2015) 14–25

Contents lists available at ScienceDirect

Cities

journal homepage: www.elsevier.com/locate/cities

City profile

Erbil

Rebwar Ismail Ibrahim [a,*], Sabah A. Mushatat [b], Mohamed Gamal Abdelmonem [c]

[a] School of Architecture and Built Environment, University of Wolverhampton, RMA Building, City North Campus, Lomas Street, Wolverhampton WV1 1HR, UK
[b] School of Energy, Geoscience, Infrastructure and Society, Heriot-Watt University, Edinburgh EH14 4AS, UK
[c] School of Planning, Architecture and Civil Engineering, Queen's University Belfast, David Keir Building, Belfast BT9 5AG, UK

ARTICLE INFO

Article history:
Received 25 August 2014
Received in revised form 24 June 2015
Accepted 2 July 2015

Keywords:
Erbil
Urban development
Citadel
Post-war Iraq
Housing

ABSTRACT

Erbil (Hawler in Kurdish), is the capital and the largest city of Iraqi Kurdistan. Having been continuously inhabited for about 6000 years, the city has recently been regarded by UNESCO World Heritage as one of the world's oldest urban settlements. The city is witnessing remarkable urban growth and rapid spatial expansion compounded by a dramatic increase in population due to emigration from the countryside and rural areas over the last three decades. Following the changing geopolitical landscape of post-war Iraq, urban changes and socio-political transformation are largely driven by Erbil's growing autonomous status as the capital of northern region of Kurdistan since 2003. This paper explores the layers of historical, spatial and social developments of the contemporary urban context of Kurdistan in general and of Erbil in particular as a reflection of the changing status of the city, as well as the polarization of Iraq and the emergence of neoliberal urbanism. The tension between the global and modern from one side and traditional and authentic from another is ever present and evident in everyday challenges in the planning of the city. In large part, Erbil's built fabric embodies the dichotomy of identity and contests between its past and future, in which the present remains a transition between two disconnected realities.

1. Introduction

After living for decades in unstable conditions, the three northern governorates of Iraqi Kurdistan, Erbil, Dohuk, and Sulaymaniyah, experienced autonomous status and self-management for the first time in 1991 as a consequence of the successful uprising of Iraqi Kurds and the removal of Saddam Hussein's regime (Stansfield, 2003). Erbil, the historical city and the capital of the Northern Province of Kurdistan Iraq, (Fig. 1), is going through fundamental changes due to the influence of political, economic, global, cultural and demographic transformations. Autonomous management of resources and revenues along with economic prosperity have allowed the city to accelerate its reconstruction and development, enjoying more stability and a safer environment in comparison to other cities in Iraq (Yasin, 2011). However, the rise in private investments and intensive planning has been counterproductive when it comes to the built environment of this ancient city. Indifferent modern planning, architecture and the urbanisation of wide streets with high-rise buildings of business establishments have created disarray in the physical form, in which both old and new, the traditional and the modern appear alien to each other (Nooraddin, 2012).

There has been growing dissatisfaction with recent development projects and new compounds around the old city over the lack of planning vision (Ebraheem, 2013). The predominantly unplanned growth has been incidental and does not constitute a sustained approach but that inscribed by unpredictable implications of the growing population and increasing economic assets (Rydin, 2010). This paper explores historical, physical and social layers which accompany those transformations. Although the current urban context of Kurdistan in general and of Erbil in particular is evidently closer to being thought of as a mere production of neoliberal policies, the debate however on globalism and modernism versus traditional and cultural is on-going.

2. Narratives of historic developments

The Kurds are one of the oldest nations in the Middle East, distinct from Arab, Persian and Turkish neighbours. Scholars agree that the Kurds are descendants of a mixture of Indo-European people formed from indigenous inhabitants and subsequent immigrants who have settled in the region for more than three thousand years (Gunter, 2011). Their history stretches from 3000 to 400 BC as a period of severe disturbances between Kurdistan and the

* Corresponding author.
E-mail addresses: rebwar_i@yahoo.com (R.I. Ibrahim), smushatat@hotmail.com (S.A. Mushatat), m.gamal@qub.ac.uk (M.G. Abdelmonem).

http://dx.doi.org/10.1016/j.cities.2015.07.001
0264-2751/

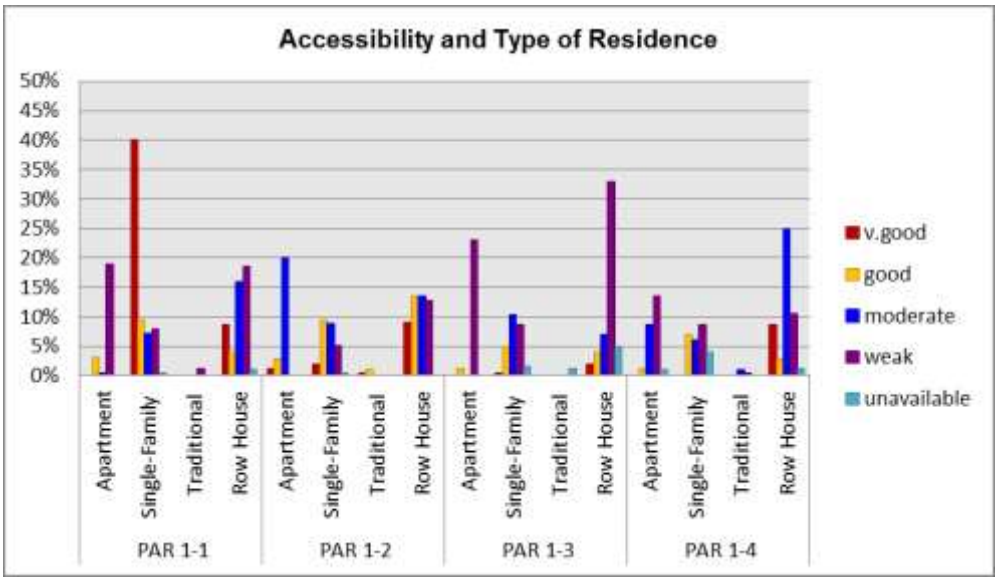
APPENDIX

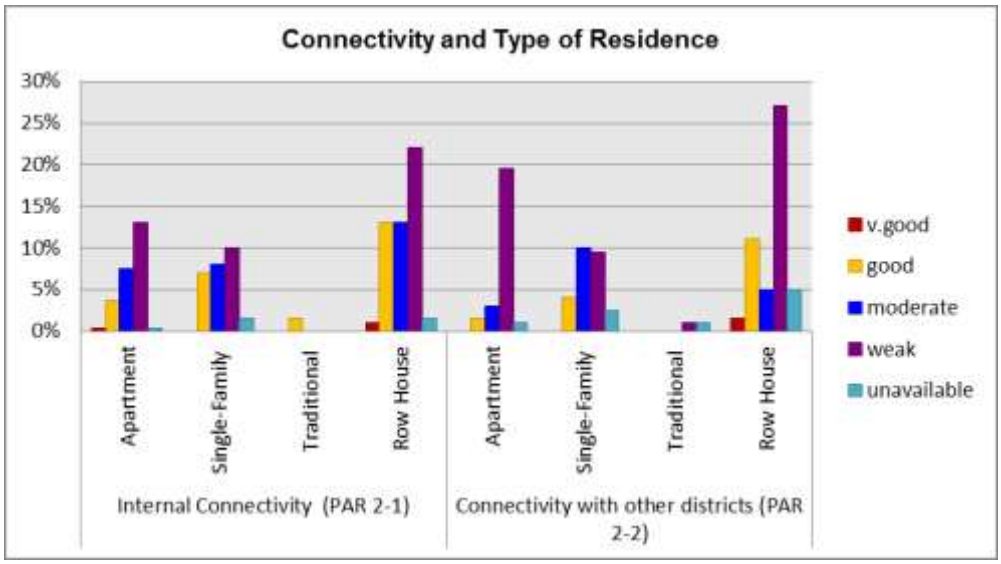
Appendix 1

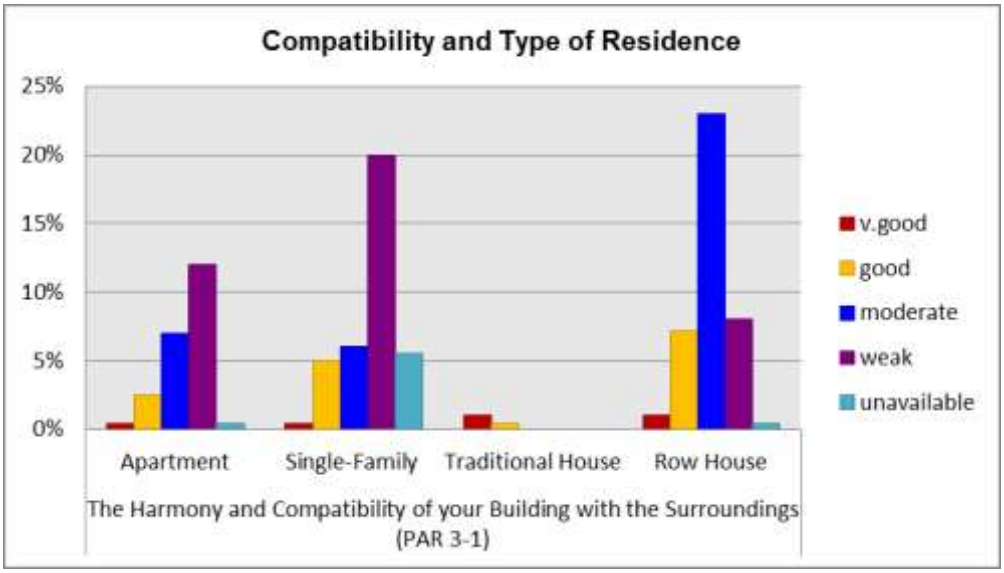
Assessment Check- List / Sustainable Urban Form Indicators

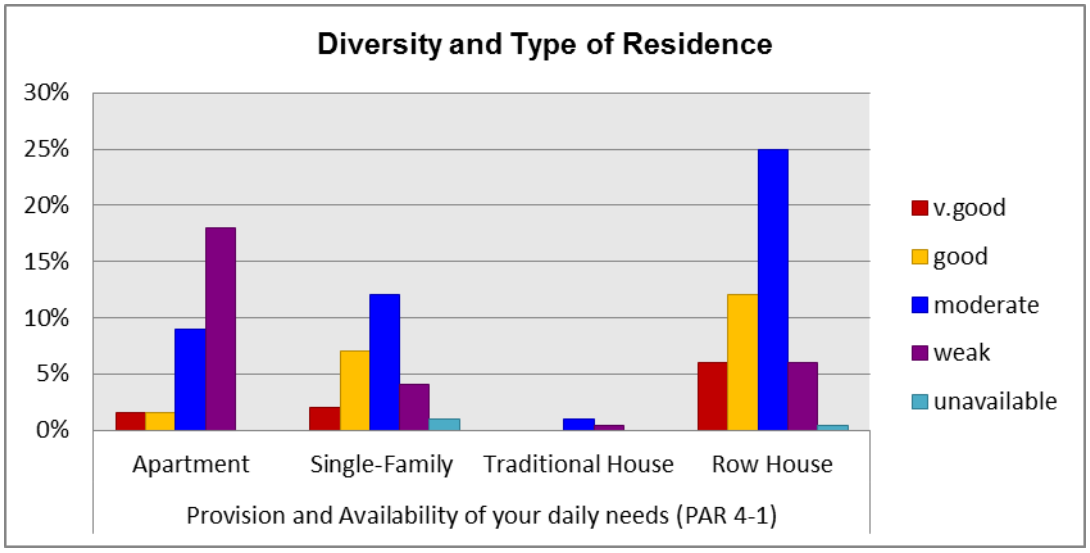
Indicators				**Scale**		
		V. Good	Good	Moderate	weak	Unavailable
1- Accessibility	Access to					
PAR 1-1	Local Services					
PAR 1-2	Buildings					
PAR 1-3	Public Transportation					
PAR 1-4	Open spaces					
2- **Connectivity**						
PAR 2-1	Internal Connectivity					
PAR 2-2	with other Districts					
PAR 2-3	Blocks Perimeter					
PAR 2-4	Col-de-Sac					
3- **Compatibility**						
PAR 3-1	Fittness and Harmony					
PAR 3-2	Unity					
PAR 3-3	Imageability and Legibility					
PAR 3-4	Richness and Control					
4- **Diversity**						
PAR 4-1	Mix of Uses					
PAR 4-2	Vitality					
PAR 4-3	Vibrancy					
5- **Containment**						
PAR 5-1	Design and Landscape					
PAR 5-2	Safety and Security					
PAR 5-3	Social Cohesion					
PAR 5-4	Scale and Proportion					
PAR 5-5	Privacy					
6- **Density**						
PAR 6-1	Building Density					
PAR 6-2	Population Density					
PAR 6-3	Contiguity					
7- **Identity**						
PAR 7-1	Physical Features					
PAR 7-2	Dynamic Activities					
PAR 7-3	Meaning and Symbols					
8- **Adaptability**						
PAR 8-1	Location					
PAR 8-2	Orientation					
PAR 8-3	Robustness and Amenities					
PAR 8-4	Management					
PAR 8-5	Public Participation					
Total Score						

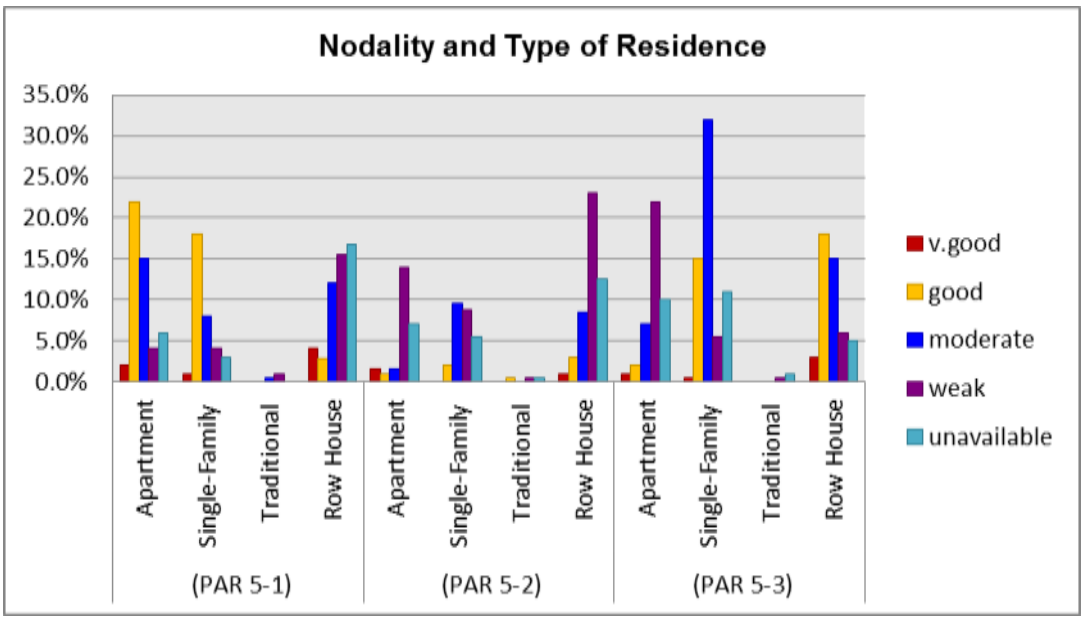
Appendix 2/ the Indicators and Type of Residence

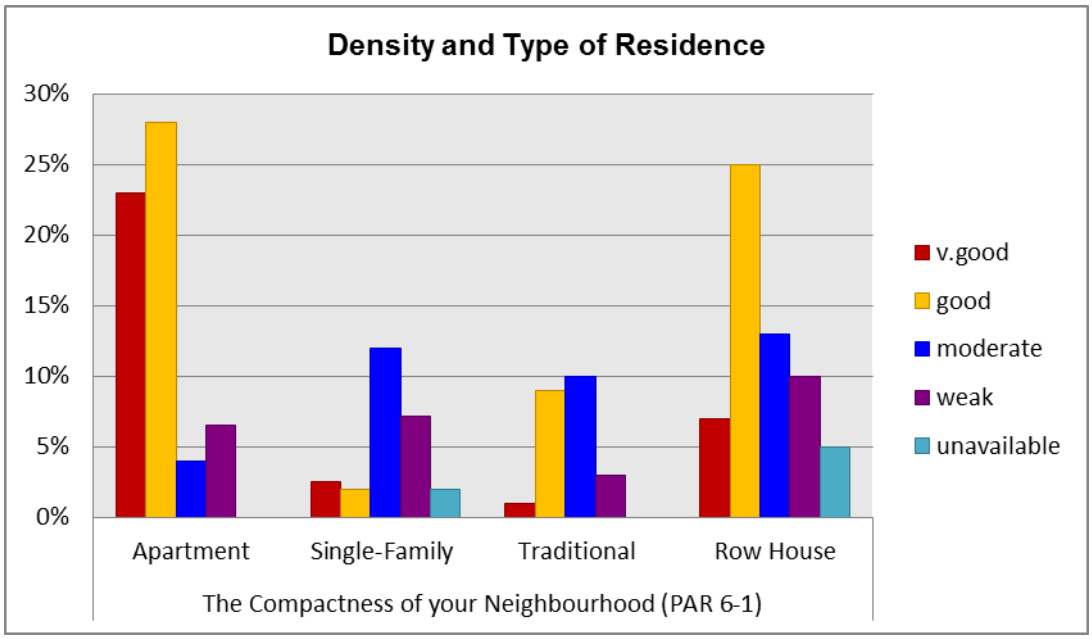


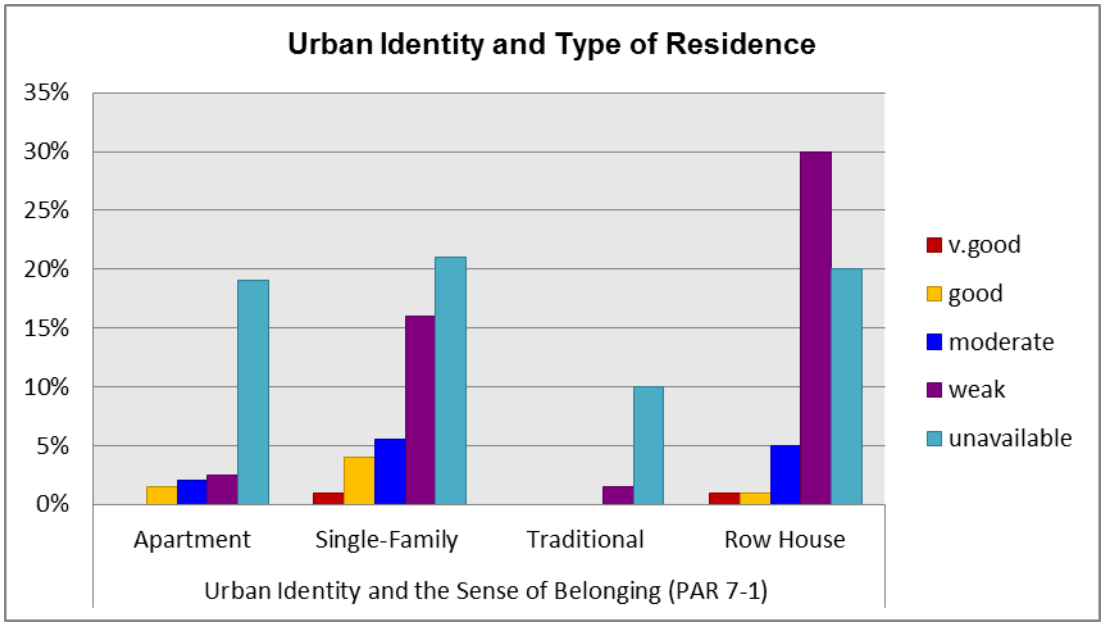


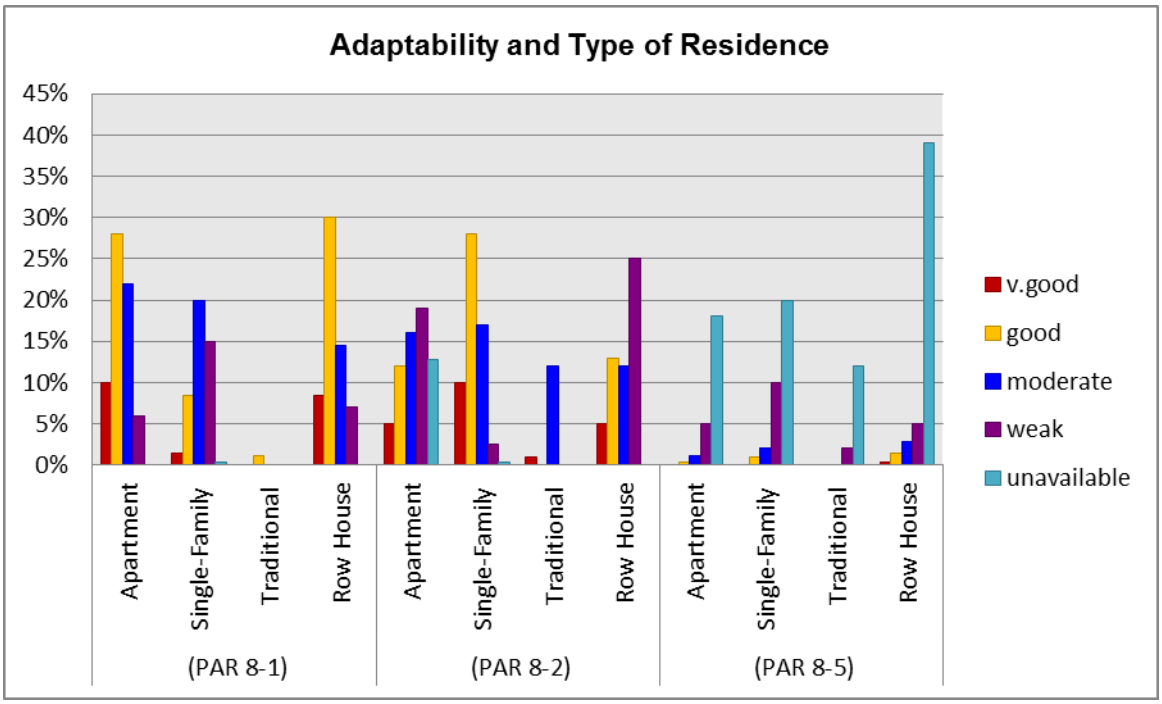



Diversity and Type of Residence
30%
25%
20%
15%
10%
5%
0%
Apartment
Single-Family
Traditional House
Row House
Provision and Availability of your daily needs (PAR 4-1)
v.good
good
moderate
weak
unavailable

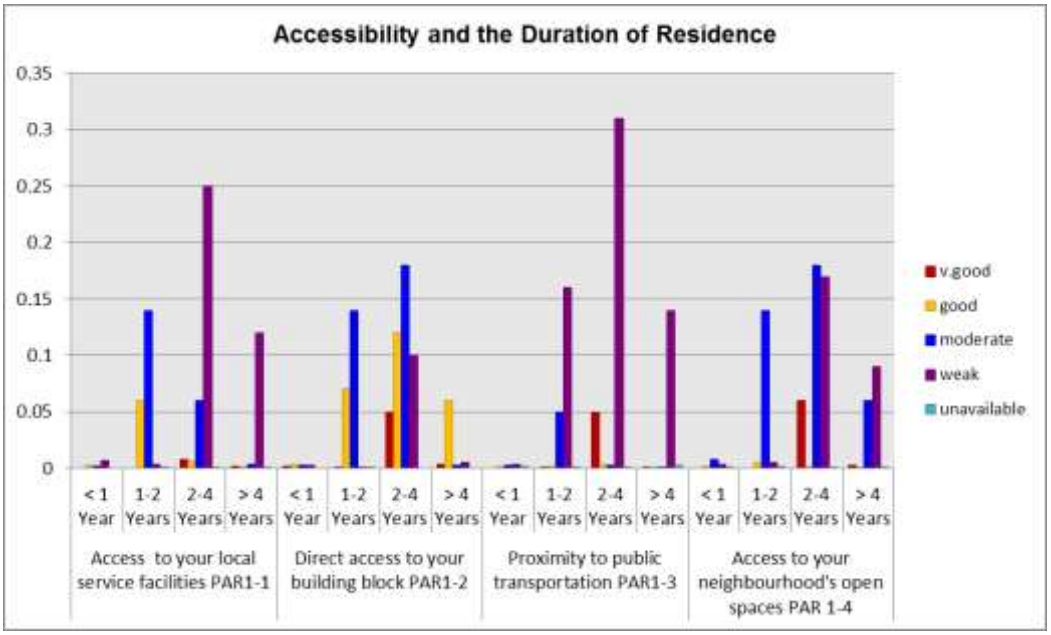

Nodality and Type of Residence
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Apartment
Single-Family
Traditional
Row House
(PAR 5-1)
(PAR 5-2)
(PAR 5-3)
v.good
good
moderate
weak
unavailable

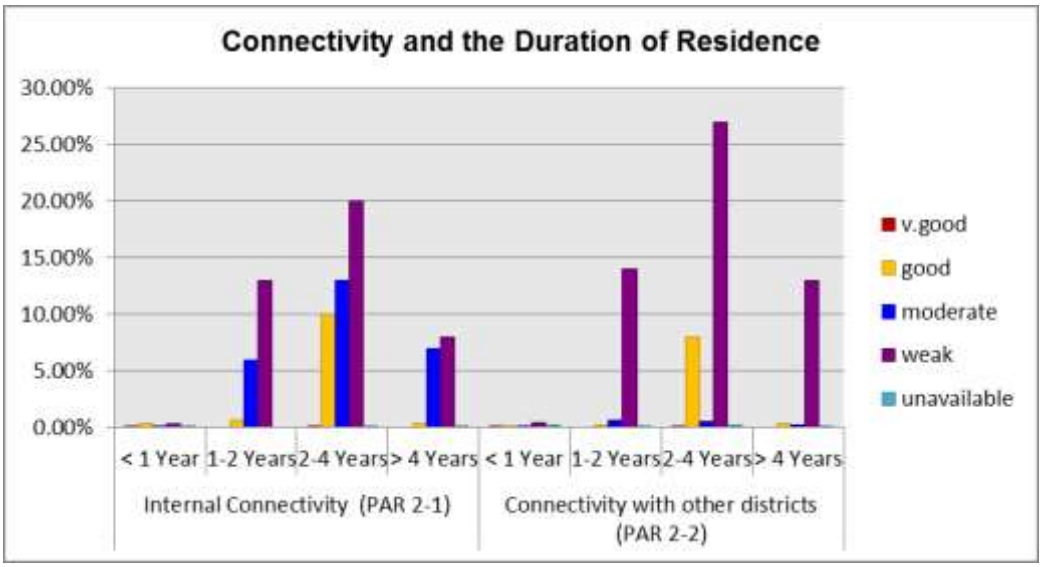

Density and Type of Residence
30%
25%
20%
15%
10%
5%
0%
Apartment
Single-Family
Traditional
Row House
The Compactness of your Neighbourhood (PAR 6-1)
v.good
good
moderate
weak
unavailable

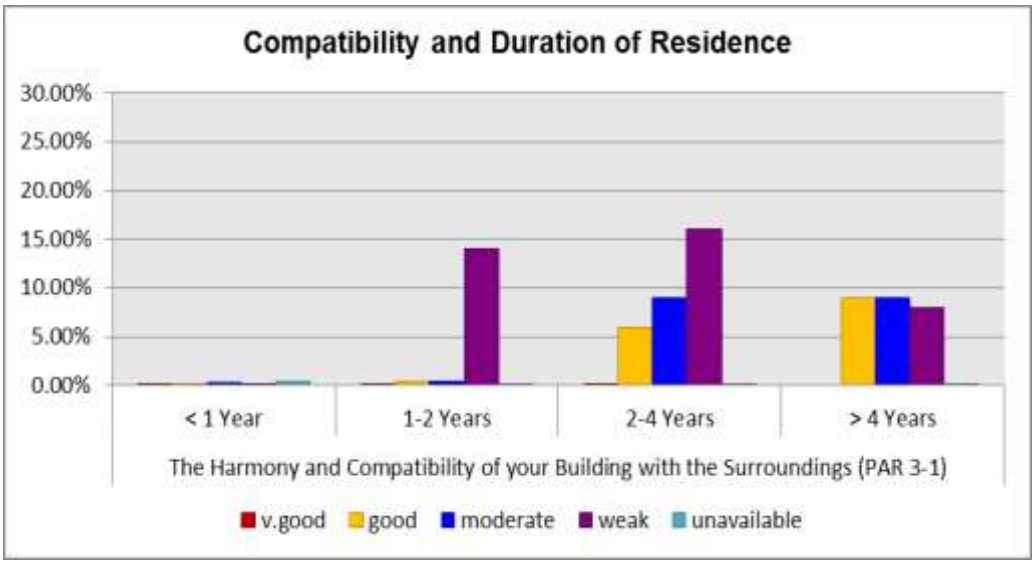

Urban Identity and Type of Residence
35%
30%
25%
20%
15%
10%
5%
0%
Apartment
Single-Family
Traditional
Row House
Urban Identity and the Sense of Belonging (PAR 7-1)
v.good
good
moderate
weak
unavailable

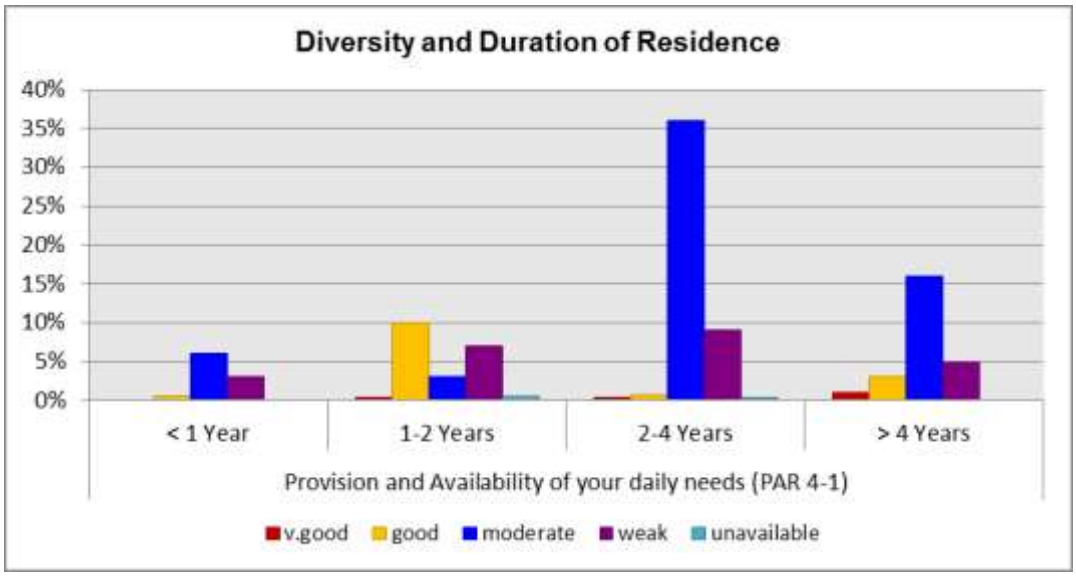

Adaptability and Type of Residence
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Apartment
Single-Family
Traditional
Row House
Apartment
Single-Family
Traditional
Row House
Apartment
Single-Family
Traditional
Row House
(PAR 8-1)
(PAR 8-2)
(PAR 8-5)
v.good
good
moderate
weak
unavailable

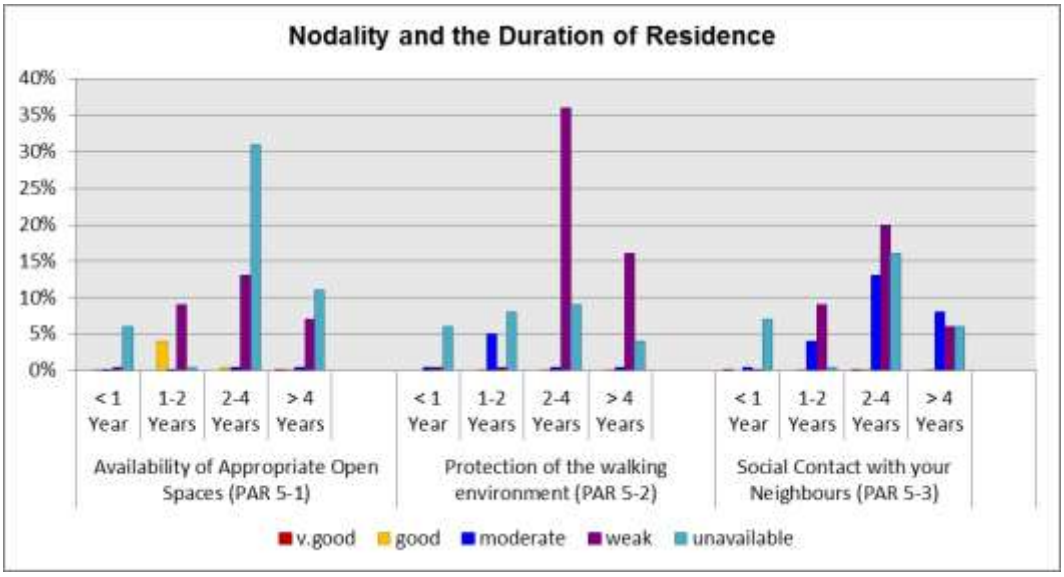
Appendix 3/ the Indicators and Duration of Residence

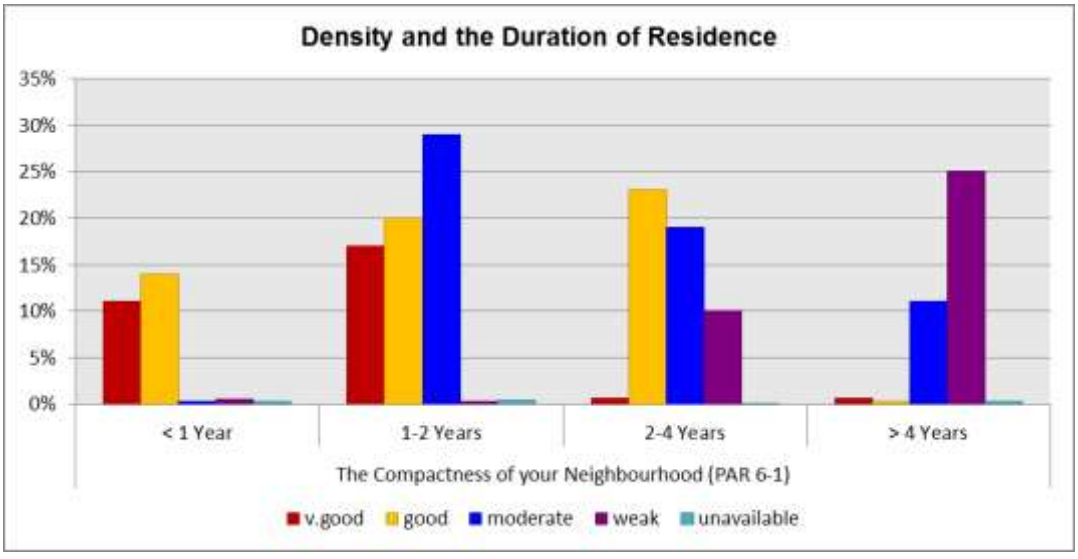


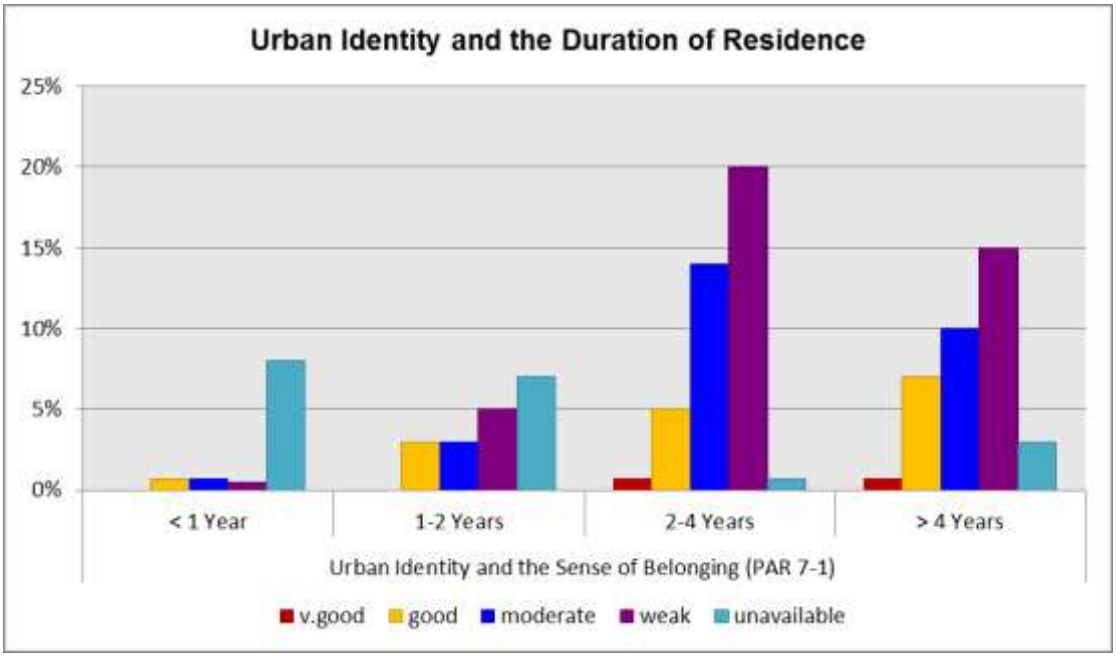


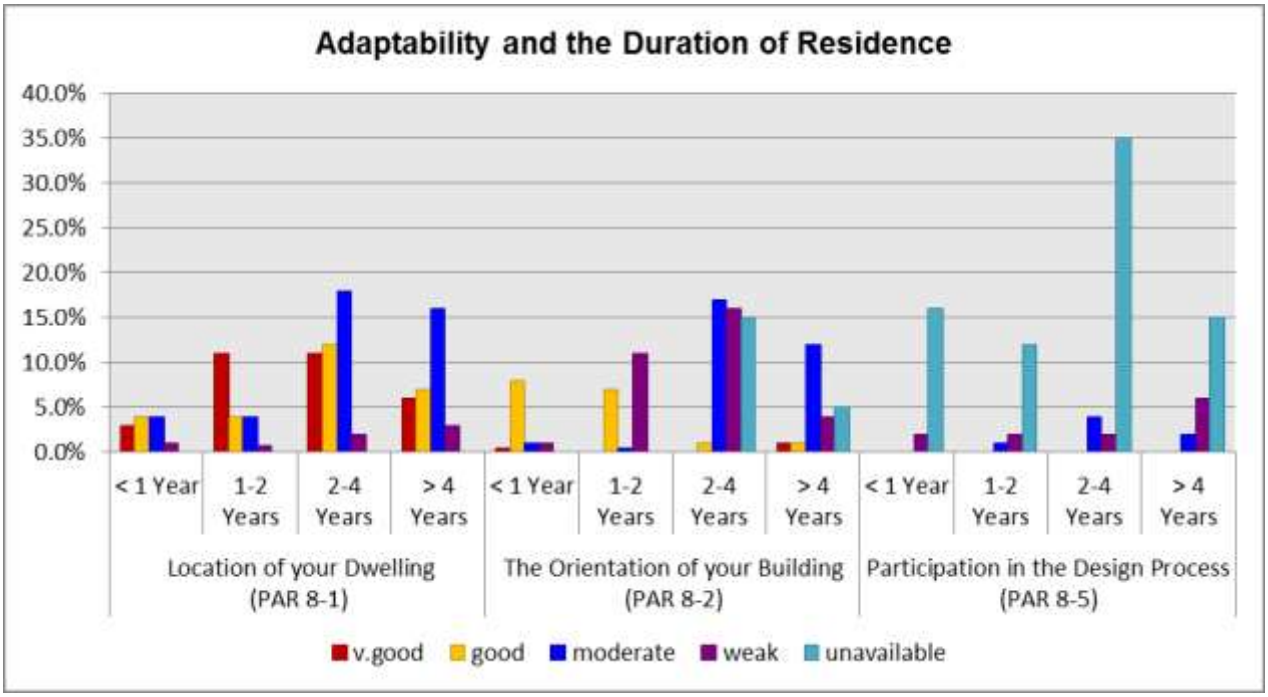



Diversity and Duration of Residence
40%
35%
30%
25%
20%
15%
10%
5%
0%
< 1 Year
1-2 Years
2-4 Years
> 4 Years
Provision and Availability of your daily needs (PAR 4-1)
v.good
good
moderate
weak
unavailable


Nodality and the Duration of Residence
40%
35%
30%
25%
20%
15%
10%
5%
0%
< 1 Year
1-2 Years
2-4 Years
> 4 Years
Availability of Appropriate Open Spaces (PAR 5-1)
Protection of the walking environment (PAR 5-2)
Social Contact with your Neighbours (PAR 5-3)
v.good
good
moderate
weak
unavailable


Density and the Duration of Residence
35%
30%
25%
20%
15%
10%
5%
0%
< 1 Year
1-2 Years
2-4 Years
> 4 Years
The Compactness of your Neighbourhood (PAR 6-1)
v.good
good
moderate
weak
unavailable


Urban Identity and the Duration of Residence
25%
20%
15%
10%
5%
0%
< 1 Year
1-2 Years
2-4 Years
> 4 Years
Urban Identity and the Sense of Belonging (PAR 7-1)
v.good
good
moderate
weak
unavailable


Adaptability and the Duration of Residence
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
< 1 Year
1-2 Years
2-4 Years
> 4 Years
Location of your Dwelling (PAR 8-1)
The Orientation of your Building (PAR 8-2)
Participation in the Design Process (PAR 8-5)
v.good
good
moderate
weak
unavailable

Appendix 4/ Descriptive Table and ANOVA Result Regarding Sustainable Urban Form Indicators Performance in the Residential Projects of Erbil City

Descriptive Analysis									
Indicators		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
Direct access to local service PAR1-1	weak	3	2.67	1.155	.667	-.20	5.54	2	4
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	2.60	.894	.400	1.49	3.71	2	4
Direct access to building blocks PAR1-2	weak	3	3.00	1.000	.577	.52	5.48	2	4
	moderate	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	5	3.00	1.000	.447	1.76	4.24	2	4
Direct access to public transport PAR1-3	weak	3	2.00	1.000	.577	-.48	4.48	1	3
	moderate	2	3.00	0.000	0.000	3.00	3.00	3	3
	Total	5	2.40	.894	.400	1.29	3.51	1	3
Direct access to open spaces PAR1-4	weak	3	3.67	.577	.333	2.23	5.10	3	4
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	3.20	.837	.374	2.16	4.24	2	4
Internal Connectivity PAR 2-1	weak	3	2.33	.577	.333	.90	3.77	2	3
	moderate	2	3.50	.707	.500	-2.85	9.85	3	4
	Total	5	2.80	.837	.374	1.76	3.84	2	4
Connectivity with other districts PAR2-2	weak	3	1.33	.577	.333	-.10	2.77	1	2
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	1.80	.837	.374	.76	2.84	1	3

Blocks Perimeter PAR2-3	weak	3	2.33	.577	.333	.90	3.77	2	3
	moderate	2	4.00	0.000	0.000	4.00	4.00	4	4
	Total	5	3.00	1.000	.447	1.76	4.24	2	4
Col-de-sac PAR2-4	weak	3	1.67	1.155	.667	-1.20	4.54	1	3
	moderate	2	4.00	0.000	0.000	4.00	4.00	4	4
	Total	5	2.60	1.517	.678	.72	4.48	1	4
Fitness and harmony PAR3-1	weak	3	3.33	1.155	.667	.46	6.20	2	4
	moderate	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	5	3.20	1.095	.490	1.84	4.56	2	4
Unity PAR3-2	weak	3	3.33	.577	.333	1.90	4.77	3	4
	moderate	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	5	3.20	.837	.374	2.16	4.24	2	4
Imageability and Legibility PAR3-3	weak	3	2.33	1.528	.882	-1.46	6.13	1	4
	moderate	2	4.50	.707	.500	-1.85	10.85	4	5
	Total	5	3.20	1.643	.735	1.16	5.24	1	5
Richness and control PAR3-4	weak	3	2.33	1.528	.882	-1.46	6.13	1	4
	moderate	2	3.00	0.000	0.000	3.00	3.00	3	3
	Total	5	2.60	1.140	.510	1.18	4.02	1	4
Mix of uses PAR4-1	weak	3	2.67	1.155	.667	-.20	5.54	2	4
	moderate	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	5	2.20	1.095	.490	.84	3.56	1	4
Vitality PAR4-2	weak	3	1.33	1.155	.667	-1.54	4.20	0	2
	moderate	2	1.50	2.121	1.500	-17.56	20.56	0	3
	Total	5	1.40	1.342	.600	-.27	3.07	0	3

Vibrancy PAR4-3	weak	3	1.33	1.155	.667	-1.54	4.20	0	2
	moderate	2	1.50	2.121	1.500	-17.56	20.56	0	3
	Total	5	1.40	1.342	.600	-.27	3.07	0	3
Design and Landscape PAR5-1	weak	3	2.67	1.155	.667	-.20	5.54	2	4
	moderate	2	3.50	.707	.500	-2.85	9.85	3	4
	Total	5	3.00	1.000	.447	1.76	4.24	2	4
Safety and Security PAR5-2	weak	3	2.67	.577	.333	1.23	4.10	2	3
	moderate	2	3.50	.707	.500	-2.85	9.85	3	4
	Total	5	3.00	.707	.316	2.12	3.88	2	4
Social cohesion PAR5-3	weak	3	2.67	2.309	1.333	-3.07	8.40	0	4
	moderate	2	1.00	1.414	1.000	-11.71	13.71	0	2
	Total	5	2.00	2.000	.894	-.48	4.48	0	4
Scale and Proportion PAR5-4	weak	3	3.67	.577	.333	2.23	5.10	3	4
	moderate	2	1.00	0.000	0.000	1.00	1.00	1	1
	Total	5	2.60	1.517	.678	.72	4.48	1	4
Privacy PAR5-5	weak	3	3.67	.577	.333	2.23	5.10	3	4
	moderate	2	2.00	0.000	0.000	2.00	2.00	2	2
	Total	5	3.00	1.000	.447	1.76	4.24	2	4
Building density PAR6-1	weak	3	2.67	.577	.333	1.23	4.10	2	3
	moderate	2	4.00	0.000	0.000	4.00	4.00	4	4
	Total	5	3.20	.837	.374	2.16	4.24	2	4
Population density PAR6-2	weak	3	3.33	1.155	.667	.46	6.20	2	4
	moderate	2	3.50	.707	.500	-2.85	9.85	3	4
	Total	5	3.40	.894	.400	2.29	4.51	2	4

Contiguity PAR6-3	weak	3	2.67	.577	.333	1.23	4.10	2	3
	moderate	2	4.00	0.000	0.000	4.00	4.00	4	4
	Total	5	3.20	.837	.374	2.16	4.24	2	4
Physical features PAR7-1	weak	3	2.00	1.000	.577	-.48	4.48	1	3
	moderate	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	5	1.80	.837	.374	.76	2.84	1	3
Dynamic activities PAR7-2	weak	3	2.00	1.732	1.000	-2.30	6.30	1	4
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	2.20	1.304	.583	.58	3.82	1	4
Meaning and symbols PAR7-3	weak	3	1.67	.577	.333	.23	3.10	1	2
	moderate	2	1.00	0.000	0.000	1.00	1.00	1	1
	Total	5	1.40	.548	.245	.72	2.08	1	2
Location PAR8-1	weak	3	2.67	1.528	.882	-1.13	6.46	1	4
	moderate	2	3.50	.707	.500	-2.85	9.85	3	4
	Total	5	3.00	1.225	.548	1.48	4.52	1	4
Orientation PAR8-2	weak	3	2.67	.577	.333	1.23	4.10	2	3
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	2.60	.548	.245	1.92	3.28	2	3
Robustness and Amenities PAR8-3	weak	3	3.00	1.000	.577	.52	5.48	2	4
	moderate	2	4.00	0.000	0.000	4.00	4.00	4	4
	Total	5	3.40	.894	.400	2.29	4.51	2	4
Management PAR8-4	weak	3	3.33	1.155	.667	.46	6.20	2	4
	moderate	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	5	3.00	1.000	.447	1.76	4.24	2	4

Public Participation PAR8-5	weak	3	1.33	.577	.333	-.10	2.77	1	2
	moderate	2	1.00	0.000	0.000	1.00	1.00	1	1
	Total	5	1.20	.447	.200	.64	1.76	1	2

ANOVA

		Sum of Squares	df	Mean Square	F Statistics	Sig. P Value
Direct access to local service	Between Groups	.033	1	.033	6.032	.003
	Within Groups	3.167	3	1.056		
	Total	3.200	4			
Direct access to building blocks	Between Groups	0.000	1	0.000	7.086	.000
	Within Groups	4.000	3	1.333		
	Total	4.000	4			
Direct access to public transportation	Between Groups	1.200	1	1.200	11.800	.000
	Within Groups	2.000	3	.667		
	Total	3.200	4			
Direct access to open spaces	Between Groups	1.633	1	1.633	12.200	.000
	Within Groups	1.167	3	.389		
	Total	2.800	4			
Internal Connectivity	Between Groups	1.633	1	1.633	9.200	.000
	Within Groups	1.167	3	.389		
	Total	2.800	4			

Connectivity with other districts	Between Groups	1.633	1	1.633	11.200	.002
	Within Groups	1.167	3	.389		
	Total	2.800	4			
Blocks Perimeter	Between Groups	3.333	1	3.333	15.000	.000
	Within Groups	.667	3	.222		
	Total	4.000	4			
Col-de-sac	Between Groups	6.533	1	6.533	7.350	.000
	Within Groups	2.667	3	.889		
	Total	9.200	4			
Fitness and harmony	Between Groups	.133	1	.133	7.086	.000
	Within Groups	4.667	3	1.556		
	Total	4.800	4			
Unity	Between Groups	.133	1	.133	9.150	.003
	Within Groups	2.667	3	.889		
	Total	2.800	4			
Imageability and Legibility	Between Groups	5.633	1	5.633	10.271	.000
	Within Groups	5.167	3	1.722		
	Total	10.800	4			
Richness and control	Between Groups	.533	1	.533	5.343	.004
	Within Groups	4.667	3	1.556		
	Total	5.200	4			

Mix of uses	Between Groups	1.633	1	1.633	11.547	.000
	Within Groups	3.167	3	1.056		
	Total	4.800	4			
Vitality	Between Groups	.033	1	.033	6.014	.000
	Within Groups	7.167	3	2.389		
	Total	7.200	4			
Vibrancy	Between Groups	.033	1	.033	11.014	.000
	Within Groups	7.167	3	2.389		
	Total	7.200	4			
Design and Landscape	Between Groups	.833	1	.833	8.789	.000
	Within Groups	3.167	3	1.056		
	Total	4.000	4			
Safety and Security	Between Groups	.833	1	.833	10.784	.000
	Within Groups	1.167	3	.389		
	Total	2.000	4			
Social cohesion	Between Groups	3.333	1	3.333	8.587	.004
	Within Groups	12.667	3	4.222		
	Total	16.000	4			
Scale and Proportion	Between Groups	8.533	1	8.533	12.002	.000
	Within Groups	.667	3	.222		
	Total	9.200	4			

Privacy	Between Groups	3.333	1	3.333	10.345	.000
	Within Groups	.667	3	.222		
	Total	4.000	4			
Building density	Between Groups	2.133	1	2.133	11.597	.000
	Within Groups	.667	3	.222		
	Total	2.800	4			
Population density	Between Groups	.033	1	.033	18.352	.000
	Within Groups	3.167	3	1.056		
	Total	3.200	4			
Contiguity	Between Groups	2.133	1	2.133	9.600	.053
	Within Groups	.667	3	.222		
	Total	2.800	4			
Physical features	Between Groups	.300	1	.300	6.222	.002
	Within Groups	2.500	3	.833		
	Total	2.800	4			
Dynamic activities	Between Groups	.300	1	.300	11.178	.000
	Within Groups	6.500	3	2.167		
	Total	6.800	4			
Meaning and symbols	Between Groups	.533	1	.533	13.939	.000
	Within Groups	.667	3	.222		
	Total	1.200	4			

Location	Between Groups	.833	1	.833	20.807	.000
	Within Groups	5.167	3	1.722		
	Total	6.000	4			
Orientation	Between Groups	.033	1	.033	4.222	.003
	Within Groups	1.167	3	.389		
	Total	1.200	4			
Robustness and Amenities	Between Groups	1.200	1	1.200	10.784	.000
	Within Groups	2.000	3	.667		
	Total	3.200	4			
Management	Between Groups	.833	1	.833	8.350	.004
	Within Groups	3.167	3	1.056		
	Total	4.000	4			
Public Participation	Between Groups	.133	1	.133	12.002	.000
	Within Groups	.667	3	.222		
	Total	.800	4			

Appendix 5/ T-Test Analysis Table1

Group Statistics

type		N	Mean	Std. Deviatio	Std. Error
Access to your local service facilities	Goup1	16	3.00	1.095	.447
	Group2	16	2.33	.516	.211
Access to your building block	Goup1	16	3.50	.548	.224
	Group2	16	3.67	.516	.211
Proximity to public transportation	Goup1	16	2.00	.632	.258
	Group2	16	2.00	0.000	0.000
Access to neighbour's green areas and open spaces	Goup1	16	3.00	1.095	.447
	Group2	16	2.83	.753	.307
Connection of your block with others in the same neighbour	Goup1	16	2.00	.894	.365
	Group2	16	1.80	.894	.365
Connection of your neighbourhood with other neighbouring districts	Goup1	16	2.67	1.033	.422
	Group2	16	2.17	.408	.167
The harmony and compatibility of your building with the	Goup1	16	2.50	.548	.224
	Group2	16	2.67	.516	.211
Provision and availability for your daily needs	Goup1	16	2.00	1.095	.447
	Group2	16	1.90	0.000	0.000
Availability of appropriate green areas and open spaces in the neighbourhood	Goup1	16	2.33	1.506	.615
	Group2	16	2.67	1.033	.422
The compactness of the neighbourhood	Goup1	16	2.80	0.751	.307
	Group2	16	3.00	1.095	.447
Social contact with your neighbours	Goup1	16	2.67	.516	.211
	Group2	16	2.00	0.000	0.000
Urban identity and the sense of belonging which related to Erbil City	Goup1	16	1.90	1.095	.447
	Group2	16	1.00	0.000	0.000
The location of your dwelling (building) in the	Goup1	16	3.00	1.095	.447
	Group2	16	3.17	.983	.401
The orientation of your building block	Goup1	16	2.67	1.033	.422
	Group2	16	2.83	.753	.307
Participation in the planning and design process of your district	Goup1	16	1.83	.983	.401
	Group2	16	1.00	0.000	0.000

Appendix 4/ T-Test Analysis Table2

Independent Samples Test

Indicators		Levene's Test for Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Access to your local service facilities	assumed	.426	.529	1.348	10	0.207	.667	.494	-.435	1.768
	not assumed			1.348	7.118	.219	.667	.494	-.499	1.832
Access to your building block	assumed	.625	.448	-.542	10	.599	-.167	.307	-.851	.518
	not assumed			-.542	9.966	.600	-.167	.307	-.852	.518
Proximity to public transportation	assumed	2.500	.145	0.000	10	1.000	0.000	.258	-.575	.575
	not assumed			0.000	5.000	1.000	0.000	.258	-.664	.664
Access to neighbour's green areas and open spaces	assumed	.086	.776	.307	10	.765	.167	.543	-1.042	1.376
	not assumed			.307	8.861	.766	.167	.543	-1.064	1.397
Connection of your block with others in the same neighbour	assumed	0.000	1.000	0.000	10	1.000	0.000	.516	-1.151	1.151
	not assumed			0.000	10.000	1.000	0.000	.516	-1.151	1.151
Connection of your neighbourhood with other neighbouring districts	assumed	11.635	.057	**1.103**	10	**.296**	.500	.453	-.510	1.510
	not assumed			1.103	6.525	.309	.500	.453	-.588	1.588
The harmony and compatibility of your building with the surroundings	assumed	.625	.448	-.542	10	.599	-.167	.307	-.851	.518
	s not assumed			-.542	9.966	.600	-.167	.307	-.852	.518
Provision and availability for your daily needs	assumed	4.000	.073	**2.236**	10	**.059**	1.000	.447	.004	1.996
	not assumed			2.236	5.000	.076	1.000	.447	-.150	2.150
Availability of appropriate green areas and open spaces in the neighbourhood	assumed	.328	.580	-.447	10	.664	-.333	.745	-1.994	1.327
	not assumed			-.447	8.853	.665	-.333	.745	-2.024	1.357
Social contact with your neighbours	assumed	40.000	.000	3.162	10	.665	.667	.211	.197	1.136
	not assumed			3.162	5.000	.065	.667	.211	.125	1.209
The Compactness of your neighbourhood	assumed	.086	.779	.307	10	.765	.167	.543	-1.042	1.376
	not assumed			.307	8.861	.766	.167	.543	-1.064	1.397
Urban identity and the sense of belonging which related to Erbil City	assumed	4.000	.074	**2.112**	10	**0.058**	0.000	.447	-.996	.996
	not assumed			0.000	5.000	1.000	0.000	.447	-1.150	1.150
The location of your dwelling (building) in the city	assumed	1.250	.290	-.277	10	.787	-.167	.601	-1.506	1.172
	not assumed			-.277	9.885	.787	-.167	.601	-1.508	1.174
The orientation of your building block	assumed	.552	.475	-.319	10	.756	-.167	.522	-1.329	.996
	not assumed			-.319	9.143	.757	-.167	.522	-1.344	1.011
Participation in the planning and design process of your district	assumed	31.250	.060	**2.076**	10	**.065**	.833	.401	-.061	1.728
	not assumed			2.076	5.000	.093	.833	.401	-.198	1.865

Appendix 6: User's Questionnaire

University of Wolverhampton

School of Architecture and Built Environment

Dear participant,

This survey is a part of an academic work and a Ph.D. research focusing on how to achieve **sustainable urban form** in the city of Erbil.

The urban form in the latest projects in Erbil (especially, the residential projects) is developing in the direction of a decreased degree of compactness, decreased degree of functional integration and an increased degree of dispersed settlement. These indicators are in conflict with the criteria and concepts regarding sustainable cities and communities.

In this sense, this study will attempt to collect some information from residents of these settlements who are the focus of our study. The purpose of this questionnaire is mostly related to the essential factors and indicators which are used in the assessment of sustainable urban form of any community in general and to improve the current performance of your neighbourhood in particular.

I appreciate your valuable contribution

Rebwar Ismail Ibrahim Al-Jaff

Postgraduate Research Student - University of Wolverhampton

Section One:-

1-**Your age**

☐18-24 ☐25-35 ☐36-50 ☐51-65 ☐> 65 (years and over)

2- **Your gender**

☐ Male ☐ Female

3- **What kind of residence do you occupy?**

☐ Apartment ☐Single-Family House ☐ Traditional House ☐ Town (Row) House

☐ Other (please specify)……

4- **How many persons are living in your dwelling (including you)?**

☐ 1-2 persons ☐ 3-5 persons ☐ 6-9 persons ☐ > 10 persons

5- **How long have you lived in this neighbourhood?**

☐ < 1Year ☐ 1-2 Years ☐ 2-4 Years ☐ > 4Years

6- **Are you:-**

☐ Student ☐ Government official ☐ Private Sector Employer ☐ Retired

☐ Jobless ☐ Other (please specify) .....

7- **Are you resident in:-**

☐ Floria City ☐ Ashti 2 ☐ Park View ☐ Italian Village ☐ Cihan City ☐ other

8- **Do you have a private car?**

☐ Yes ☐ No

9- **If yes, do you have your own parking place?**

☐ Yes ☐ No

Section Two: Please, choose the best match

How do you **evaluate** the followings**:-**

2-1- **Access to your local service facilities**

(e.g. supermarkets, schools, the health centre, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-2- **Direct access to your building block**

(e.g. from the nearest street, from adjacent blocks, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-3- **Proximity to public transportation**

(e.g. local buses, taxi, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-4- **Access to your neighbourhood's green areas and open spaces**

(e.g. direct pathways, safe and protected corridors, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-5- **Connection of your block with others in the same neighbourhood**

(e.g. walking corridors, opens paces, bridges, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-6- **Connection of your neighbourhood with other neighbouring districts**

(e.g. safe corridors, local visible streets, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-7- **The harmony and compatibility of your building with the surroundings**

(e.g. with other close blocks, with open spaces, scale, heights etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-8- **Provision and availability for your daily needs**

(e.g. markets, schools, health centre, mosque, public transportation, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-9- **Availability of appropriate green areas and open spaces in the neighbourhood**

(e.g. sitting areas, children play grounds, parking areas, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-10- **Protection of the Walking environment in the neighbourhood**

(e.g. safety, convenient, climate protection, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-11- **Social contact with your neighbours**

(e.g. visiting, interaction in neighbour's public area, going together in picnics, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-12- **The compactness of your Neighbourhood**

(e.g. distance between the blocks, size of open spaces, population intensity, etc)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-13- **Urban identity and the sense of belonging which related to Erbil City**

(e.g. physical features or symbols which reflect the city's identity)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-14- **The location of your dwelling (building) in the city**

(e.g. closeness to city centre, main streets, famous attractive places, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-15- **The orientation of your building block**

(e.g. sun penetration, ventilation, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2-16- **Participation in the planning and design process of your district**

(e.g. get information, meetings with executive authorities, developers and designers, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

Thank You Very Much for Your Time and Cooperation!

Appendix 7: Expert Questionnaire

University of Wolverhampton

School of Architecture and Built Environment

Dear participant,

This survey is a part of an academic work and a Ph.D. research focusing on how to achieve **sustainable urban form** in the city of Erbil.

The urban form in the latest projects in Erbil (especially, the residential projects) is developing in the direction of a decreased degree of compactness, decreased degree of functional integration and an increased degree of dispersed settlement. These indicators are in conflict with the criteria and concepts regarding sustainable cities and communities.

In this sense, this study will attempt to collect some information from residents of these settlements who are the focus of our study. The purpose of this questionnaire is mostly related to the essential factors and indicators which are used in the assessment of sustainable urban form of any community in general and to improve the current performance of your neighbourhood in particular.

I appreciate your valuable contribution

Rebwar Ismail Ibrahim Al-Jaff

Postgraduate Research Student

University of Wolverhampton

Section One:-

1-**Your age**

☐18-24 ☐25-35 ☐36-50 ☐51-65 ☐> 65 (years and over)

2- **Your gender**

☐ Male ☐ Female

3- **What kind of residence do you occupy?**

☐ Apartment ☐Single-Family House ☐ Traditional House ☐ Town (Row) House

☐ Other (please specify).....

4- **How many persons are living in your dwelling (including you)?**

☐ 1-2 persons ☐ 3-5 persons ☐ 6-9 persons ☐ > 10 persons

5- **How long have you lived in this neighbourhood?**

☐ < 1Year ☐ 1-2 Years ☐ 2-4 Years ☐ > 4Years

6- **Are you:-**

☐ Student ☐ Government official ☐ Private Sector Employer ☐ Retired

☐ Jobless ☐ Other (please specify) .....

7- **Do you have a private car?**

☐ Yes ☐ No

8- **If yes, do you have your own parking place?**

☐ Yes ☐ No

Section Two: Please, choose the best match

How do you **evaluate** the followings:-

1- **Access and proximity to your local service facilities**

(e.g. supermarkets, schools, the health centre, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

2- **Direct access to your building block**

(e.g. from the nearest street, from adjacent blocks, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

3- **Proximity to public transportation**

(e.g. local buses, taxi, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

4- **Access to your neighbourhood's green areas and open spaces**

(e.g. direct pathways, safe and protected corridors, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

5- **Connection of your block with others in the same neighbourhood**

(e.g. walking corridors, opens paces, bridges, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

6- **Connection of your neighbourhood with other neighbouring districts**

(e.g. safe corridors, local visible streets, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

7- **The appropriateness of your block perimeter (lengthen)**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

8- **The availability of Col-de-sac near your residence**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

9- **The harmony and compatibility of your building with the surroundings**

(e.g. with other close blocks, with open spaces, scale, heights etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

10- **The unity of architectural elements in the elevation and the site of your district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

11- **The legibility of you building or your district from the main street**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

12- **The richness of architectural details in the site**

(e.g. furniture, materials, landscaping, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

13- **Provision and availability for your daily needs**

(e.g. markets, schools, health centre, mosque, public transportation, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

14- **The vitality and energy of the activities in your district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

15- **The vibrancy and the liveability in your district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

16- **Availability of appropriate green areas and open spaces in the neighbourhood**

(e.g. sitting areas, children play grounds, parking areas, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

17- **Protection of the Walking environment in the neighbourhood**

(e.g. safety, convenient, climate protection, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

18- **Social contact with your neighbours**

(e.g. visiting, interaction in neighbour's public area, going together in picnics, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

19- **The human scale and proportion between the buildings and their surroundings**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

20- **The provision of privacy in your neighbourhood**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

21- **The compactness of your Neighbourhood**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

22- **Population density in the neighbourhood**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

23- **The contiguity of your building in the site**

(e.g. proximity between the buildings, closeness to your neighbour, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

24- **Urban identity and the sense of belonging in your district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

25- **The availability of daily activities which enhances your attachment to the district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

26- **The availability of local symbols or architectural details which refer to your city**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

27- **The location of your dwelling (building) in the city**

(e.g. closeness to city centre, main streets, famous attractive places, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

28- **The orientation of your building block**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

29- **The robustness of your building (structure)**

(e.g. sound and thermal insulation, stable condition, construction materials and finishing)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

30- **The project management, administration and maintenance in your district**

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

31- **Participation in the planning and design process of your district**

(e.g. get information, meetings with executive authorities, developers and designers, etc.)

☐ Very Good ☐ Good ☐ Moderate ☐ Weak ☐ Unavailable

Thank You Very Much for Your Time and Cooperation

Appendix 8: Questionnaire in Kurdish /First Page

زانكوي وولظەرهامتۆن

خوێندطاي زانستي تەخشەكێشان و دروستكردني دةووروبةر

بةشداري بةڕێز,

ئةم روونيوة بةشيكة لة كاريكي ئةكاديمي و توێذينةوةي وةرطرتني ثلةي دكتوراة (ث اض.د) تيشكوي ثالثشتكردني فؤرمي شار .لةتاو شاري هةولێردا

لةو هةستةوة, خوێندنةوةكة هةولي كۆكردني زانيارية لة هاولاتياني شاري هةولێر كة تيشكوي خوێندكاكانيةتي. ئامانجي ئةم ثرسيارنامةيةش ئةوةندي طشتي هةية لةطةل هۆكارةكاني هةلسةنطاندن بؤ ثالثشتكردني فؤرمي شار بة شێوةيةكي زۆرينةيي .لة هةر كۆمةلطايةك بة طشتي و طةشةثيداني جيهةجيَ كردني نيستا بةتايبةتي دراوسيةتي خؤت

بةشداربوونت يةخرخ دةزانم

رێبوار اسماعيل أبراهيم ألجاف - خوێندكاري دةرضووي توێذينةوة- زانكوي وولظەرهامتۆن

يةشي يةكةم:

1-تةمةنت

☐18-24 ☐25-35 ☐36-50 ☐51-65 ☐> 65 (سال وزياتر)

2-رةطةزت

☐ مێينة ☐ نێر

3-جۆري نيشتةجێ بوونت؟

☐ خانووي دةستوري ☐ شوقة ☐ نيوة خانی(سةربةخۆ) ☐ طيللة

☐ ئةوةي تر (دياربكة).....

4-ضةند كةس شيكةوة دةذين لة خانووةكةدا(تۆش لةطةليان)؟

☐ 1-2 كةس ☐ 3-5 كةس

☐ 6-9 كةس ☐ 10 كةس و زياتر

5-لةطةل دراوسيةكانت ضةند دةبي ئيكةوة دةذين؟

☐ 6 مانطة يا كةمتر

☐ 12-24 مانطة

☐ 24 مانطة و زياتر

6- بةرنيزت(دةتواني لةيةك زياتر هةلبذيري:

☐ خوێندكار ☐ فةرمانبةر

☐ ئةندازياري تةلارساز(نةخشة كێش)

☐ كةسيك ثاريَ طرةو لةسةركراوي لادةدرنيت

☐ نيشتةجيَ لة ناوضة.....

☐ ئةوةي تر (ديارىكة).....

Appendix 9: Interview Questions

Interview Questions

Candidate name: .....

Occupation: .....

Time, date and place: .....

Section 1: General Questions

1- What are the most important projects that you have recently designed (participated or supervised) locally and internationally?

2- What are the most significant planning and urban problems within the current residential projects in Erbil city and Kurdistan?

3- Please, identify the future actions or trends (planning and design level) needed to improve and achieve sustainable residential districts in Erbil City?

Section 2: Context Questions

1- There are many concepts and approaches to arrange the urban and residential blocks (in the term of density like compact, dispersed, or in the term of axial like linear, central ...etc.). Do you think that this planning aspect has significant impact in achieving higher performance and more sustainable residential projects in Erbil City?

2- What are the common local approaches and concepts in the planning and arrangements of buildings and urban forms? Is there a specific model or approach that considers the most appropriate direction to achieve the superlative sustainable performance in the residential projects?

3- Globally, there are many sustainable indicators and factors which are thoroughly considered in the planning and organisation of the urban form to achieve the highest performance. In your opinion, what are the most significant sustainable indicators and criteria to perform that locally?

4- Do you believe that the Local Planning Policy Guidance provides sufficient regulations (programmes) related to the construction of modern residential projects and according to the sustainable global criteria?

Section 3: Specific Questions

1- What impact, do you think compact policies will have on the living conditions in the city of Erbil? Do you think higher densities will have negative effects locally?

2- Do you think the reflection of the urban identity of Erbil (physical features, perceptual aspects and symbolic characteristics) can be considered a significant indicator in achieving a sustainable local context? Please, clarify practically how to perform that?

3- The provision of good project management and maintenance is an essential dimension in the global sustainable cities and residential districts. Do you think that this factor is totally considered in the local residential projects?

4- Urban nodes and well-designed open spaces are one of the important requirements in achieving sustainable social neighbourhoods globally. How do you describe these elements in similar local projects?

5- Identify a distinctive and meaningful residential district in Erbil, why have you chosen this location, and what are the characteristics and features that make it so distinctive? In this sense, most recent residential projects in Erbil are characterised by defensive walls. Do you think this aspect even fortify these communities functionally and socially?

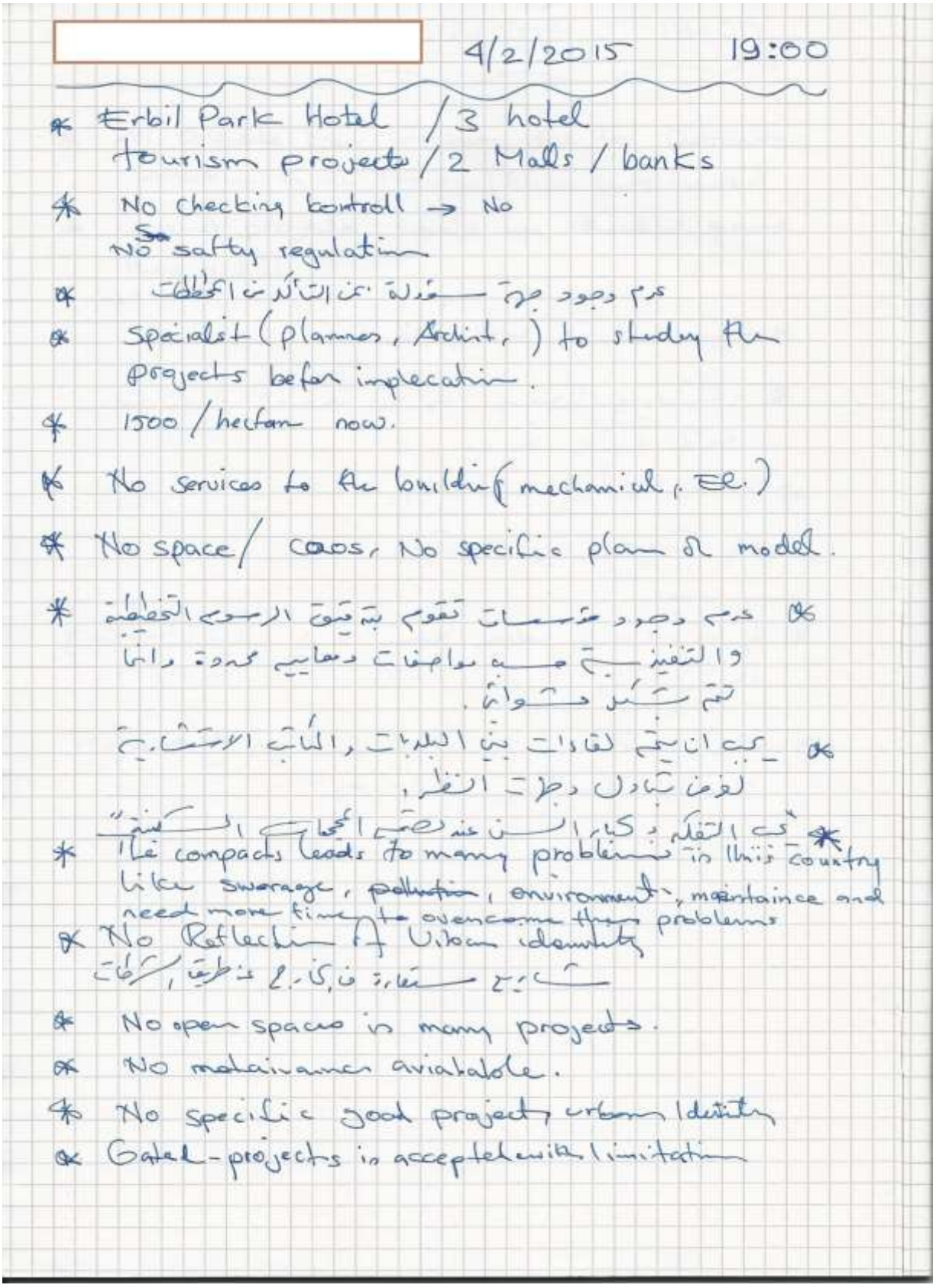
Thanks a lot for your time and cooperation!

Rebwar Ismail Ibrahim Al-Jaff

School of Architecture and Built Environment

University of Wolverhampton

Appendix 10: A Face to Face Interview Sample Transcript



4/2/2015 19:00

* Erbil Park Hotel / 3 hotel tourism projects / 2 Malls / banks
* No checking controll → No No safty regulation
* عدم وجود جهة مسؤولة عن التأكد من السلامة
* Specialist (planner, Archit.) to study the projects befor implecation.
* 1500 / hectar now.
* No services to the building (mechanical, El.)
* No space / caos, No specific plan & model.
* عدم وجود مؤسسات تقوم بتتبع الرسوم التخطيطية والتنفيذ حسب مواصفات ومعايير محددة وانما تتم بشكل عشوائي.
* كيف ان يتم لقاءات بين البلديات، والشركات الاستشارية لتبادل وجهات النظر.
* في التقليد وكبار السن عند تصميم المجمعات السكنية
* The compacts leads to many problems in this country like swerage, pollution, environment, maintaince and need more time to overcome these problems
* No Reflection of Urban identity
* عدم وجود معايير تنظيمية لكل منطقة
* No open spaces in many projects.
* No maintainance aviabable.
* No specific good projects urban identity
* Gated-projects is acceptable with limitation

Appendix 11/ Ethical Research Form

UNIVERSITY OF WOLVERHAMPTON
SCHOOL OF TECHNOLOGY

ETHICAL CONSIDERATION FOR RESEARCH PROGRAMMES

Section 1: Your details			
First Name & Surname:	**Rebwar Ibrahim**	**Student No:**	**1232048**
Project Title	**Sustainability and the Organisation of Urban Form in Erbil City-Iraq**		
Director of Studies:	**Prof. Sabah Mushatat**		

Section 2: Your Project Topic	
2.1 The Studies related to Urban Settlements, their components of Urban Form and the establishments of theories for Sustainable cities have already been traced by many researchers and planners. Consequently, the physical form of cities has been shown to have a crucial impact on urban sustainability. Achieving sustainable urban development in rapidly growing and developing countries is the recent concern among researchers and planners since they are witnessing a dramatic growth of urban cities. However, in the context of cities of developing countries research on the urban form that can deliver sustainability has not been much explored. Therefore, the relevance of spatial organisation of buildings has remained untested in these cities. Erbil, the historical city in the Northern Province of Kurdistan, Iraq, is passing through rapid urban and socio-political transformation following its growing autonomous status as the capital of this region since 2003. Economic prosperity has allowed the city to accelerate its reconstruction and development enjoying more stability and a safer environment in comparison to other cities in Iraq. Indifferent modern planning, architecture and the new liberal organisation systems of wide-open streets with high-rise buildings of business establishments result in a clear state of randomness and disarray in the physical form. The research intends to examine the relationship between spatial pattern of modern residential districts and sustainable development to evaluate the current urban form of Erbil city.	
2.2 Will information or artefacts resulting from your project be available externally to the University?	Yes
2.2.1 **If you answered 'yes' to 2.2,** Will any such information place anyone at risk or possibly result in any action that might be detrimental to their wellbeing? (See guidelines)	No
2.2.2 In what format will the information or artefacts be made available?	Thesis soft and hard will be kept in the university library and these could be borrowed by researchers. Results of the study will also be published in journals and conference proceedings.

Please attach samples with this form if you intend to do interviews, surveys, or questionnaires.	
3.1 Does any part of your proposed project involve human participants?	**Yes** **If 'no' proceed to section 4**
3.2 Please explain any aspects of the project, which might be detrimental to the wellbeing of any human participants in your project.	
Nothing	
3.3 Are there other ways you might meet your project aims without involving human participants? If not, why?	
No, Because I need to take human response and feedback. I will use questionnaires and direct interviews to get these responses.	
3.4 How will you select your participants?	
Regarding this study, different parts of the society will be engaged in the analysis including precisely users, architects, students, planners and decision makers and stakeholders.	
3.5 How many participants will you contact? **Around 300 participants from the above selected groups**	

3.6 How will you approach potential participants? E.g. email, letter, face to face? Please append text of any letter or email? Participants for the interviews **Participants to be approached by Face-to-Face, and Emails contact.**	
3.7 Are your participants adults? (over 18 and competent to give consent) If no, answer 3.7.1. (See guidelines) **Yes**	
3.7.1 Are your participant's children or adults under 18 and not competent to give consent? If yes, why is it necessary to involve these participants?	**No**
3.8 Are you offering any incentives to any of your participants, financial or otherwise? (See guidelines)	**No**
3.9 How much time do you estimate will be needed from any participants? (See guidelines)	**About 20 minutes to answer the complete questionnaire** **About 1 hour to discuss each focus group, if necessary**
3.10 Please list the method of data collection and analysis intended to be used **The research data will be collected through a mixed method techniques including qualitative and quantitative surveys.** The qualitative case study survey includes the observational study for urban form in Erbil City, semi-structured interviews and documentation analysis. The quantitative part will be depending on holistic related questions in the questionnaire survey. Statistical Analysis is the final stage where the data will be analysed in two aspects. The first will focus on qualitative analysis for visual building elements using comparative tables while the second analysis will rely on quantitative analysis (descriptive, factor analysis, correlation analysis and multi regression analysis). Then the outcome data will be statistically analysed by SPSS program.	
3.11 Will all of the data collected contribute towards your results?	**Yes.**

Section 4: Confidentiality and data handling	
Please read methods of ensuring confidentiality in the guidelines.	
4.1 Will you ensure the anonymity of data collected from/and about participants?	**Yes**
4.1.1 Please explain how this will be achieved.	
All the Data will be protected. Names of individuals will not be used while processing data. Instead, codes will be used to represent the respondents only in the experts questionnaires'. A password will be used to access the file containing the data and this password will not be given to anybody.	
4.2 Will you store/protect data collected from individuals e.g. password protected files?	**Yes**
4.3 Once your project is complete and information is no longer needed, will you destroy your data?	**Yes**
4.4 Will anyone else have access to the data collected?	**Yes**
If so, (i) please name the individuals and/or groups that will have access;	**(i) My supervisors, who are:** **(ii) Professor Sabah Mushatat** **(iii) Dr. Mohammed G. Abdelmonem**

(ii) why is access being given to those listed in (i)?	**(iv) Dr. Kadda Yahiaoui** **(v) Assessors may also want to see the data**

Section 5: Working with other parties and companies	
5.1 Will you be using data on subjects held by another party or organisation?	**No**
If Yes, (i) Please give details. (ii) How will you gain access to this information?	
5.2 Do you require written permission from a company, organisation or location, e.g. an employer or local authority?	**No**
If Yes, (i) Please complete an external agreement form and include this with your submission.	
NB: If working with another organisation or company please familiarise yourself with their Health & Safety procedures.	

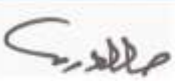
Things you must be aware of:

Data Protection Act: http://www.ico.gov.uk/what_we_cover/data_protection.aspx
Freedom of Information Act: http://www.opsi.gov.uk/Acts/acts2000/ukpga_20000036_en_1
University of Wolverhampton Ethical Approval Procedural Guidelines

Checklist:

1. If you are using a questionnaire or interview sheet please include a list of sample questions with your submission.
2. In addition, please include an introductory cover letter stating some information about you, your project proposal and how your data will be used.
3. If you are undertaking a project involving a company or organisation you will need to show that you have approval from that organisation. Please include a completed copy of the External Agreement Form.

Student's Declaration Sign and date against **one** declaration **only**	
Category 0. My project involves no human participation except for myself and I agree to ensure that any information or artefact produced will not be available outside the University.	
Category A1. My project involves limited human participation and I agree to ensure that (i) any such participation is not detrimental in any way to the interests of the participants; (ii) all information collected as a part of the project will be handled in accordance with the answers that I gave to question **4**; (iii) No information or artefacts which may place anyone at risk or be detrimental to their wellbeing will be made available outside the University.	Rebwar Ibrahim 15.10.2014
Category A2. My project involves human participation and may present some risk to participants. I have considered alternative means of pursuing the project which do not entail this risk but believe that there is no practicable alternative. I agree to ensure that I take all necessary steps to minimise risks to participants and third parties. I agree not to proceed with any activities involving human participation until I have received approval from the Department Ethics Panel.	
Category B-E. My project does not conform to Category 0, A1 or A2. I have considered alternative means of pursuing the project which do not entail risk to human participants but believe that there is no practicable alternative to the proposal made. I agree to ensure that I take all necessary steps to minimise risks to participants. I	

Director of Studies/Principal Investigator's Declaration Sign and date against **one** declaration **only**	
Category 0 or A1. I concur with the classification of this project as **0** or **A1** and authorise continuation of the project pending consideration by the School Ethics Committee	
Other. I believe that this project should be classified other than **0** or **A1.** I will ensure that no activities involving human participants take place until and unless approval is granted by the School Ethics Committee	

FOR SUPERVISOR/PANEL/COMMITTEE USE ONLY:

CLASSIFICATION ALLOCATED BY SUPERVISOR									
0, A1		**Supervisor Action:** Authorise and forward to SEC 					Date	10/10/2014	
Other		**Supervisor Action:** Refer to DEP for decision					Date		
	CLASSIFICATION ALLOCATED BY SCHOOL ETHICS COMMITTEE								
	0, A1		**SEC Action:** Continuation of project approved				Date 16/10/2014		
	A2, B		**Considered by SEC below**				Date		
			2.3 Is any risk associated with access to project acceptable in context? If no, give reasons below:			Yes		No	
			3.1 Is involvement of human participants justified? If no, give reasons below:			Yes		No	
			3.3 Is experimental method acceptable with regard to risk and inconvenience to participants? If no, give reasons below:			Yes		No	
			4 Are arrangements for confidentiality and data protection appropriate? If no, give reasons below			Yes		No	
			5 Do arrangements for working with external bodies protect interests of participants and the external bodies? If no, give reasons below			Yes		No	
			SEC Action: Continuation of project approved:	Yes	✔	No		Date	
			Conditions:						
	Other		**SEC Action:** Refer to University Ethics Committee				Date		